ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LVI. No. 23. CHICAGO, SATURDAY, JUNE 4, 1910. ISSUED WEEKLY.

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY
CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood, Manager.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall, Manager.

CHARLES W. PRICE .....Editor-in-Chief
A. A. GRAY .....Managing Editor
MORTON GITHENS LLOYD .....Technical Editor
HENRY FARRINGTON .....Associate Editor
F. H. BERNHARD .....Associate Editor
H. EHRLICH .....Associate Editor
C. H. SEAVER .....Associate Editor

SUBSCRIPTIONS.

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS 1145
The St. Louis Electric Show 1148
W. W. Freeman 1149
NATIONAL ELECTRIC LIGHT ASSOCIATION.....1150
Technical Sessions 1150
Power Transmission Section Session 1153
Anniversary Session 1154
Commercial Sessions 1157
Company Section Session 1160
Accounting Sessions 1161
Concluding General and Technical Sessions.....1162
Convention Notes 1163
Chicago Electric Club 1168
Chicago Railway Men Confer in New York.....1168
Bids for Lighting Plant 1168
Commercial Telegraphers' Union 1168
Magnetic Hysteresis in a Rotating Field.....1169
Electric Show in Montana 1170
Continental Rubber Company Buys Mexican Property.....1171
A Magnetic Balance 1171
Merritt Bill Passes 1171
Wireless Between France and Nova Scotia.....1171
Atlantic & Suburban Railway Sold.....1171
Electric Power for Dredging.....1171
Localization of Faults on Underground Mains.....1172
Artificial Rubber 1174
Ohio Society of Mechanical, Electrical and Steam Engineers.....1174
Electrical Supplies Imported by Canada.....1174
Technical Publicity Association 1174
Regulation and Illumination 1175
Rensselaer Polytechnic Institute offers Scholarship.....1177
A Telephone Relay.—I.....1178
Telephone Office Discipline 1180
A Typical Rate Problem in Small Telephone Properties.....1181
Modern Electric Time Service 1182
To Reduce Cable Rates 1183
AMONG THE CONTRACTORS AND SUPPLY MEN.....1184
Report on Block Signals 1185
Navy Wireless Tests Begin 1185
The Elimination of the Horse.....1185
FINANCIAL REPORTS OF ELECTRICAL COMPANIES.....1185
Metropolitan Reorganization 1185
INDUSTRIAL SECTION 1186
CURRENT ELECTRICAL NEWS.....1191
RECORD OF ELECTRICAL PATENTS 1197

Copyright 1910, by the Electrical Review Publishing Company.

CONSERVATION AND WATER POWER.

That this is a live question among electrical engineers was made manifest by the interest taken in the discussion of Mr. Doherty's paper at the convention of the National Electric Light Association. This paper is abstracted in the report of the meeting of the new Power Transmission Section in this issue. Mr. Doherty took the ground that conservation of natural resources is best advanced by making the widest use possible of our neglected sources of water power. The water which is now running to waste, and sometimes doing positive damage by flood, represents a lost opportunity. Every horsepower which is developed from this source would mean a saving of so much coal. Coal is one of our exhaustible resources, whereas water supply is inexhaustible.

This point of view seems entirely reasonable, and the only one consistent with a true policy of conservation, although the federal government does not seem to realize this, if we judge only by the progress which has so far been made toward utilizing the available sites for such projects.

At the present time it is apparently impossible to get capital for any new projects on the public domain, as investors are not satisfied with the legal status of the properties concerned. It has been claimed that no restrictions should be put upon the development of these projects, since the public interest demands their early completion, and if power be not supplied by the operating company at prices which encourage its use, the company can be the only sufferer. The company takes all the risk, the customer can only be benefited or he will not be a customer.

But the question is larger than this. Similar arguments may be made for a steam railroad or a street-railway project. Many of the latter were launched without restrictions, and many communities are today suffering as a sequel. Just as no wise city council today grants unlimited franchises, so our federal officials have been farsighted enough to realize the danger of perpetual grants of the control of a public service. The development of a water power is a natural monopoly, as regards the delivery of power to a particular community. In the western states, the rights to water are not vested in the owners of the land past which the water flows, but in the commonwealth. Where streams are not navigable and do not form state boundaries, legal

control would seem to rest in the state rather than the federal government. But with the examples of devotion to the public interest now being displayed by the legislatures of New York and Illinois, our federal officials would be deserting the people's interests to leave hands off. Through control of the land necessary to build powerhouses, they have control of the situation.

If these developments were to proceed unrestricted, we should soon witness the spectacle so often presented by the railroads, where the individual has had to pay "all the traffic will bear." And not only is rate regulation necessary, but the rights of future generations must be protected by avoiding grants in perpetuity of that which belongs of right to the people. With these objects in view, our officials may be pardoned for going slow.

Engineers may do the country a service by making the people realize that waterpower projects, however, should be hastened by every possible means. Conservation demands not the repression, but the encouragement, of this work. Policies should be elaborated to completion at once, and, under proper regulation, development should proceed just as rapidly as men can be secured to undertake it. The public in general do not realize it, but the engineers may help not only by advising public officials, but by helping to educate the populace along these lines.

AN INSURANCE AGAINST BREAKDOWNS.

That the electric motor is the best if not the only insurance against loss of time in industrial establishments in case of breakdowns, is evidenced by instances of this sort related in recent issues of two of our contemporaries.

The first case is recorded by the *Engineering Record*, and, singularly enough, occurred in the electrically operated plant of the Pabst Brewery at Milwaukee, Wis. The stoppage was not due to an electrical defect, but to the explosion of four of the eight 400-horsepower boilers utilized in this plant to run the generators. By an arrangement with the Milwaukee Electric Railway and Power Company, three transformers were installed shortly after the explosion, taking current from this power company's mains to run the induction motors which are used to operate the machinery in the brewery. Thus very little delay was experienced and a considerable amount of direct loss and inconvenience was averted. This would not have been possible by using any other than electric-motor drive.

The second instance is recorded by the *Electrician*, of London, England. In this case a serious breakdown occurred in a textile mill in Blackburn, England, due to the breaking of a pinion which resulted in a general smash-up of the driving machinery. An investigation showed that at least three weeks would be consumed in making the necessary mechanical repairs, a delay which would have proved very serious on account of the holding up of some very important orders. Here again the electric motor solved the difficulty, power being taken from the mains of the local municipal electricity department. The breakdown occurred on a Friday (April 29 last) and by the following Monday 100 looms out of a total of 820 were set to work. On Tuesday 100 more looms were in use, the next day another 100, and on the Thursday a further 250. A unique method of parallel running of differently powered electric motors had to be adopted in one instance, on account of the fact that a motor of sufficient size for driving a certain department was not available.

The above experiences certainly show the value of the electric motor for emergency use in breakdowns—continued use will show its value on all occasions.

ROTARY HYSTERESIS.

Ewing's theory of magnetism postulates that the ultimate particles of a magnetic substance are inherent magnets, retaining permanently their magnetic condition, and producing a combined apparent effect which depends upon the arrangement or position of the composite or elemental magnets in the given body.

This theory explains satisfactorily the experimental facts of varying permeability and of hysteresis, which are typical of all ferromagnetic substances. It was at one time considered that these elemental magnets might be nothing else than the elemental chemical atoms, since the magnetic properties seemed to be associated with particular chemical elements.

This idea was later shown to be untenable, for it is in conflict with three experimental facts. (1) Nonmagnetic alloys of two magnetic elements, nickel and iron, have been made. (2) Magnetic alloys have been made of substances which alone display no marked magnetic properties. (3) The magnetic quality of most magnetic substances, and particularly of steel and other alloys, depends largely upon their physical treatment and conditions.

The last fact indicates also that magnetic quality is not even a molecular property, but that the elemental magnets must consist of groups of molecules, and that such physical treatment as hammering, tempering, or even a change of temperature, greatly affects this grouping.

One of the early objections raised against Ewing's theory was that if a specimen were subjected to a rotating field strong enough to produce saturation, the theory indicated that no energy would be expended to keep up the cyclic magnetization. When Baily tried the experiment and found that in an increasing field the hysteretic energy actually passed a maximum and then diminished with approaching saturation, it created great astonishment, and the experiment was regarded as a strong confirmation of the theory. A number of investigators have since performed similar experiments with like results. The method has almost invariably been to measure in some way the torque exerted upon the specimen by a revolving field. A brief account of some of these experiments is given on another page of this issue.

Professor Herrmann, in a book published last year, and

again in an article appearing in a recent issue of the *Elektrotechnische Zeitschrift*, describes some experiments in which a different method was used and in which entirely different results were obtained. It is evident that the subject requires further investigation, and offers a field for research which should yield results of great importance both to the theory and to the electrical industry.

In most electrical machinery containing a rotor part, the condition to which the iron core is subjected is neither a purely alternating magnetic flux nor a purely rotating one. Different parts of the core experience different sequences of flux, both as to direction and magnitude, and at some places there is a superposition of rotary and alternating fields. It has been impossible to predetermine core losses from any general magnetic constants of the material, only an actual test of a similar core giving sufficiently reliable data.

It would seem at first sight as though the manufacturer of electrical machinery would be deeply interested in this question of a disappearance of hysteresis in a rotary field at saturation, and would have thoroughly investigated the subject from an industrial standpoint. For it would seem that by properly shaping the core, saturating the iron, and making the field more purely rotary, hysteresis might be entirely eliminated. When we consider the practical conditions of operation, however, the advantages of such a condition fade away, for saturation can be attained only by using very intense fields, and the necessary increase of copper loss would offset the diminished iron loss. It is no doubt due to a realization of this fact by designing engineers that has confined the investigation of these phenomena to the laboratories of the scientific workers.

ELECTROLYTIC AMALGAMATION.

One of the most recent applications of electricity in gold mining is electrolytic amalgamation, by which many values in slimes, black sand, coated or rusty gold, and gold associated with certain elements, are recovered, and by which that objectionable phenomenon known as the "flouring" of mercury is avoided. By the use of weak currents of electricity properly applied, in conjunction with the addition of sodium chloride (common salt) to the pulp, the mercury is kept automatically in a highly active state. The sodium chloride is electrolyzed into its elements, sodium and chlorine, the former tending to amalgamate with the mercury and cause it to have a greater affinity for the gold. The sodium also combines with the running water and this liberates nascent hydrogen, which reduces metal oxides attached to microscopic particles of gold and enables the latter to be taken up by the mercury to form amalgam. The new process thus makes available for treatment large volumes of gold-bearing sands which otherwise could not be profitably treated, besides increasing the efficiency of gold recovery from slimes, etc., hitherto worked by other processes.

THE CENTRAL STATION AND THE TECHNICAL GRADUATE.

The arrival of the commencement season in the college world emphasizes again the attractive powers of the electrical industry to newly created graduates. The great manufacturing companies have canvassed the leading institutions pretty thoroughly in their search for promising young men. The electric railways will furnish employment for many technically trained minds and hands during the next few months. The central stations deserve to profit by an infusion of fresh and active blood, but the opportunities of this branch of the electrical art are not as widely appreciated as is desirable, in comparison with the other more spectacular divisions of electrical engineering practice.

The outlook for the technical graduate who enters central-station work at the present time has been much improved within the past few years by two great tendencies in the field of electrical service: the concentration of the business into more efficient and powerful organizations, and the scientific basis now adopted by the more progressive companies in the sale of power. Here the technical graduate finds a splendid opportunity to rub elbows with men of varied temperaments, to work out problems on a real engineering basis, and to participate in the economies which follow broad schemes of power centralization. To be able to sell electricity for power service in competition with other supplies calls for genuine engineering skill and probably less of the "spell-binding" qualifications than are needed in most other commercial and technical occupations. The field is anything but saturated. Power loads are still trifling compared to the burdens which will be carried soon by active companies. Production and distribution efficiency is susceptible to vast improvement. The graduate of 1910 may well "think on these things" and find them "of good report."

TELEPHONE RELAYS.

We reprint in this issue the first part of a notable paper by Mr. S. G. Brown, presented at a recent meeting in England before the Institution of Electrical Engineers. While Mr. Brown has not solved entirely the problem of telephone relaying, his instrument acting only in one direction, an important advance has been made in the clearness of articulation produced by the apparatus which he describes. Furthermore, it is extremely probable that an immediate use will be found for Mr. Brown's invention in the widely diverse fields of wireless telegraphy and medical diagnosis, besides preparing the way for a practical solution of what many have hitherto claimed as an impossible problem, the automatic relaying of speech over the telephone. The principle used in Mr. Brown's relay seems to be a sound one, and it is quite possible that further investigation on similar lines will produce a practical relay.

St. Louis Electric Show.

The electrical exhibition that was held in the Coliseum in St. Louis during the convention of the National Electrical Association, May 23 to 27, inclusive, was one of the marked features of that week's great gathering of electrical men. A detailed account of it is given in connection with the convention report on other pages of this issue. The League of Electrical Interests, which is the Electric Club of St. Louis, arranged with the bulk of the exhibitors to retain their exhibits for a public electric show to be given on the five days following the convention.

As a result the first St. Louis Electric Show was held on May 28 to June 2 and created widespread interest and enthusiasm. Practically all the space in the Coliseum was taken, for besides the National Electric Light Association exhibits, which have been already alluded to, there were exhibits by the following firms and companies:

Union Electric Light and Power Company.
Department of Electrical Engineering of Washington University.
Dielectric Manufacturing Company.
Corby Supply Company.
St. Louis Brass Manufacturing Company.
Commercial Electric Supply Company.
F. E. Newberry Electric Company.
Economical Electric Lamp Company, New York city.
Stoltz Electrophone Company.
Sefton Manufacturing Company, Chicago.
Perfection Vacuum Cleaner Company, Chicago.
John Hague.
H. H. Humphrey.
Perfect Arc Light Company.
Gleeson, Brokaw Electric Company.
C. J. & F. E. Briner.
St. Louis Electric Heating Company.
Ralph Owen, Springfield, Ill.
Reeves & Skinner.
G. W. Witmer.
J. H. Offner, Bloomington, Ill.
Automatic Electric Washer Company, Newton, Ia.
Brilliant Sign Company.
Imperial Manufacturing Company, Independence, Kas.
General Vibrator Company, Long Island City, N. Y.
Mermod, Jaccard & King.
Scruggs, Vandevoort & Barney.
United Railways Company.
Van Nort Brothers.
International Export and Supply Company.
Commercial Electric Supply Company.
Phoenix Auto Supply Company.
Unless otherwise stated, the above exhibitors were from St. Louis.

The exhibit of the Union Electric Light and Power Company consisted of a modern house suitably furnished throughout and equipped with all the latest electric devices for use in the home. An intercommunicating telephone system had a station in each room and also a trunk line connection to the central telephone exchange. In each room were electric fans on swinging brackets and, of course, all rooms were suitably and appropriately lighted. In the bed room there was a shaving set on the dresser, an electric hair curler, a massage machine and a hair dryer. Near the bed there was a portable stand reading lamp, an electrically heated milk bottle, and an electric foot warmer. There was also an electrically driven sewing machine in this room and a luminous electric heater. In the living room there were located a luminous grate, reading lamp, electric bracket fan, electric flower vase, cigar lighter, vacuum cleaner, tea kettle and coffee percolator. The dining room had a table set with dishes and decorated with smilax and carnations in which incandescent lamps were concealed. There were also a tea kettle, coffee pot, water heater, electric toaster, electric corn-popper, chafing dish, and luminous electric heater. In this room, in addition to the bracket fans there was a small electric exhaust fan. The room was also decorated with electric flowers. In the kitchen there were in operation an electric refrigerator, a small Emerson electric motor on a stand with a countershaft for driving an ice cream freezer and other apparatus. There were also displayed an electric dish-washing machine, two electric ranges, an electric fireless cooker, electric waffle irons, etc. The laundry contained a Jewel electric washing machine, an American Ironing Machine Company's electric iron, a Chicago Dryer Company's electric clothes dryer, electric flat irons, etc. In the yard, which was carpeted with green to imitate a lawn, there was a flower bed filled with electric flowers, comprising roses, tulips, etc. Connected with this modern home was a machine shop in which were shown an electric welding machine welding iron and steel, an automatic envelope machine, also a shoe half-soling department comprising a stitcher, an edger, a sander, and a buffer furnished by the Flemming-Landis Machine Company.

The United Railways Company had a very instructive exhibit showing the history and development of the modern electric street car. At one end of the exhibit was horse car No. 3 from the Bellefontaine line, of the type considered palatial twenty-five years ago. This car was ten feet in length and seated twelve passengers. At the other end of the exhibit was a modern standard steel car of the P-A-Y-E pattern built by the United Railways' shops in St. Louis. It is forty-eight feet in length, seating forty-eight passengers and is equipped with four forty-horsepower motors. The exhibit included all of the electric equipment of a modern street car system such as track switches, fire-hose jumpers, etc.

Washington University had an interesting scientific exhibit with students in charge explaining the scientific principles that were demonstrated.

The Bell Telephone Company's exhibit included two eighty-line section switchboards each with an operator handling all the business throughout the Electric Show. There were also a small thirty-line section, and a still smaller three-line section with seven stations designed to go on a stenographer's desk and be handled without an extra operator.

The Reeves & Skinner Machinery Company showed an Alberger two-stage turbine pump, equipped with a Westinghouse three-horsepower motor, this unit being in operation pumping water. A large chart was shown giving the efficiency and characteristic curves of this unit.

The Gleeson-Brokaw Electric Company showed the Polar flaming arc lamp, Eck dynamos and motors, the Reliable vacuum cleaner, Shelby incandescent lamps and also beautiful electric flowers, made by Gudeman & Company, of New York.

The Automatic Electric Washer Company, of Newton, Ia., showed a number of electric washers and wringers in operation.

The American Washer Company had a similar exhibit.

F. E. Newberry & Company had a booth decorated with flowers, showing large photographs of buildings equipped by them and a map of the United States with different colored stars representing the different contracts executed by them throughout the country, including many for the United States government.

The Brilliant Sign Company showed an electric fountain in operation and various electric signs including the word "Brilliant" in scintillating lights.

At the booth of the General Compressed Air and Vacuum Machinery Company the Thurman vacuum cleaner was shown in operation. This booth was also appropriately decorated with electric flowers.

The Corby Supply Company showed the Duntley vacuum cleaner and a complete line of the Chicago Pneumatic Tool Company's tools.

The International Export and Supply Company exhibited the Frink reflector system, C. & C. motors, Jandus fans, wires, etc.

Van Nort Brothers had on exhibition a complete line of Robbins & Myers electric fans and motors and carbon brushes of their own manufacture.

Scruggs, Vandevoort & Barney showed a complete, elaborate and beautiful line of electric stand lamps.

The Commercial Electric Supply Company had a comprehensive exhibit of electric supplies, including wire, switches, tablet boards, fixtures, batteries, bells, etc.

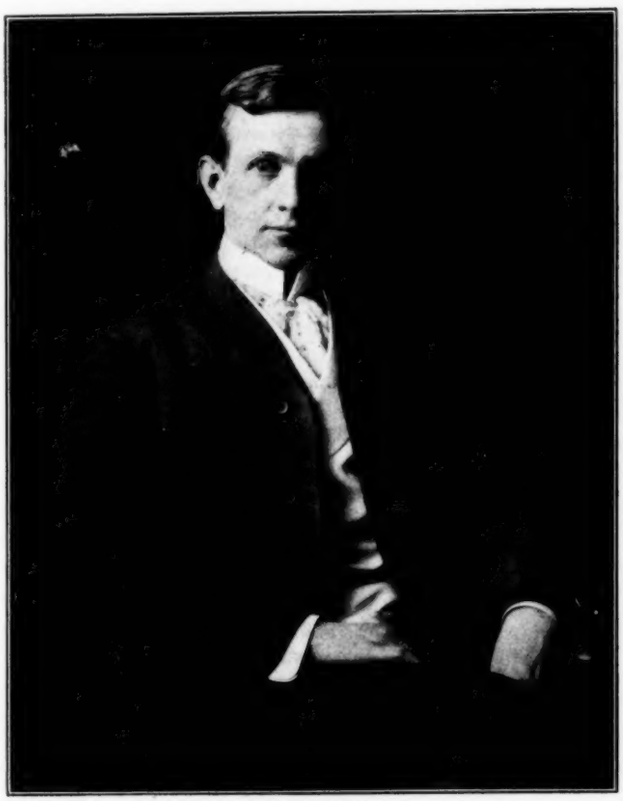
Charles J. Sutter exhibited heating apparatus, tablet boards, electric fans and various wiring devices.

W. W. Freeman.

"When in the course of human events" it became necessary once again to select a president to lead the National Electric Light Association to greater achievements, there was one man who loomed large on the horizon of possibilities. If anyone raised the question last week as to who was going to be the next president the answer was "Why, Freeman!" and when the report of the nominating committee was sent in we all settled back with a reflective smile and said "I told you so," for W. W. Freeman has been making his way toward the presidency for some time.

Years ago it was realized that he was of presidential timber, and it only waited for the mutations of time to make it possible for him to fit nicely into the niche which the purposes of destiny and the reward of good service were preparing for him.

Weldon Winans Freeman, endowed by nature with a fine generous and chivalrous nature, has long been regarded by his colleagues as a man of the greatest integrity, and he has been an upstanding exponent of all that is honest and decent in the management of corporation affairs. His rapid advancement to the present high position he holds in the executive department of his company is the natural result of a career which has been marked preeminently by a devotion to the interests of those in whose service he has been employed.



W. W. FREEMAN,
President of the National Electric Light Association.

Mr. Freeman was born at Exeter, Ontario, Canada, June 8, 1872. His parents were Asahel Davis Freeman and Louisa Ann Winans. He was educated in the grammar and high schools at Listewel, Ontario, and after graduating high in his class entered the employ of Hess Brothers, furniture manufacturers, of Listewel. He remained with this concern until he decided to come to the United States. In 1889 he entered the service of the Edison Electric Illuminating Company of Brooklyn as a stenographer. He was soon made private secretary to the general manager, and then in steady leaps was promoted to assistant secretary, then secretary, treasurer, and finally vice-president and general manager. In this position Mr. Freeman is the active executive head of the concern with full responsibility.

The elevation of Mr. Freeman to his present post carried with it promotion to similar positions in companies allied with the Edison Illuminating Company, and in addition to these positions Mr. Freeman as a private individual has acquired interest in other concerns of various sorts. Besides his most important executive position he now occupies the following posts: Vice-president and general manager of the Kings County Electric Light and Power Company; vice-president and general manager of the Amsterdam Electric Light, Heat and Power Company; president of the Edison Construction Company; treasurer and director of the Electrical Testing Laboratories, and director of the Electrical Show, Incorporated.

Mr. Freeman has just been elected president of the National Electric Light Association. He is a past president of the Association of Edison Illuminating Companies, and is a member of the American Institute of Electrical Engineers, Illuminating Engineering Society, New York Electrical Society, Manufacturers' Association of New York, Brooklyn League, and the Canadian Society of New York.

Mr. Freeman is active in the social life of his home community, and is a member of the following clubs: Brooklyn, Crescent Athletic, Union League of Brooklyn, Long Island Automobile, Masonic Club of Brooklyn, Engineers' Club of New York, Congregational Club of Brooklyn, and Belle Terre Club of Port Jefferson, Long Island. He has always been an active member of the Congregational Church, and has been president of the Manhattan-Brooklyn Conference of Congregational Churches, and president of the Congregational Club.

In 1895 he married Miss Ellen Burrows, of Brooklyn, and they have three children, a daughter and two sons. Mrs. Freeman is a devoted partner in many of the activities in which Mr. Freeman is interested, and she is a member of numerous patriotic and social orders of national scope. Among these are the Mayflower Society, Daughters of the American Revolution, Colonial Daughters of the Seventeenth Century, Society of New England, and the Cosmos, Civitas, Brooklyn Women's and Friday Afternoon Clubs.

At the executive session of the National Electric Light Association at which Mr. Freeman was declared elected president it was announced that the administration of President Frueauff had marked the highest record of achievement in the life of the association. President Frueauff, in tendering to Mr. Freeman the badge of office, predicted that no administration would outshine in brilliancy that which was forthcoming under the executive leadership of Mr. Freeman. A high standard has been set and to carry on the great work which has been so far furthered requires a man of great capability. W. W. Freeman has been well trained, under Frueauff, Eglin and Farrand, he is a big man all by himself, we sincerely believe he is the right man in the right place and we wish for him a most successful administration.

National Electric Light Association.

Thirty-third Convention and Twenty-fifth Anniversary, St. Louis, Mo., May 23-27.

The thirty-third convention and twenty-fifth anniversary of the National Electric Light Association was a notable event from every point of view. There was a registration of 2,644 names of members and guests, and the unattached visitors swelled the attendance nearly to the three thousand mark. The weather was excellent, with a clean, cool atmosphere in the meeting rooms and a fine bracing air for the outdoor entertainment. The local committee and the general arrangement committee had things perfectly set for the comfort and enjoyment of the visitors.

The following pages contain the reports of the proceedings of the Wednesday afternoon and Thursday and Friday sessions, and a complete description of the exhibits, together with comment upon some of the more interesting features of the convention. The report of the proceedings of the opening session and the Tuesday and Wednesday morning sessions appeared in last week's issue.

Technical Sessions.

The Technical Sessions were very ably presided over by W. W. Freeman, one of the live wires of the convention. The first session was held on Wednesday morning and was opened by the reading of the report of the Overhead Line Construction Committee by Farley Osgood. This was followed by papers on "Location of Faults in Underground Cables" by W. A. Durgin, and on "Departure from Standard Practice in Distribution Methods" by S. B. Way. Abstracts of these, with the discussion, were given in our last issue.

The reports of the committees on Grounding Secondaries and on Terminology were also presented. The latter will be printed in full in a later issue. The former report was abstracted in our last issue. The discussion which was postponed until the afternoon session will also be treated at length at a later date.

SECOND TECHNICAL SESSION.

The second Technical Session on Wednesday afternoon was opened with the report of the Meter Committee, which was presented by G. A. Sawin, chairman.

REPORT OF METER COMMITTEE.

The committee has joined hands with the meter committee of the Association of Edison Illuminating Companies to solve the problem of what constitutes acceptable meters and acceptable meter practice. The result of this work will be a "meter code," of which Sections 1, 2, 3, 4 and 7 were submitted. These sections cover definitions, standards, metering, specifications of meter types and methods of test, while the three sections yet to be prepared concern auxiliary apparatus, methods of installation and system tests. This code will be treated at greater length in our next issue. The report showed that the number of meters tested and the average accuracy had increased each year. Descriptions were given of new meters which had appeared on the market during the year, and of the new installation devices. The equipment of testers' kits and of the meter shop were considered, and blank forms for keeping the various records were given. Legal requirements were also discussed.

In connection with this report the committee prepared an exhibit of meters and meter testing apparatus which attracted much attention and interest during the convention. The different forms of meters in use were mounted for inspection, together with various accessaries used in meter installation. Attendants were on hand to demonstrate the different methods of test, and the use of the different apparatus.

F. G. Vaughan opened the discussion by congratulating the committee on its thorough work. A few years ago the meter was looked upon as a luxury and received little attention. The necessity of proper upkeep is now realized, and meter men should co-operate with the committee in enforcing respect of meters upon operating companies.

J. B. Seaman stated that in Philadelphia the eye and ear method had been used and found superior to the usual method with the rotating standard. The expense of testing has been reduced forty per cent below that with indicating instruments, and the method is quicker than that using a switch in the potential circuit of the rotating standard.

P. Lupke pointed out that the greatest gain in accuracy was at full load, although the light load accuracy had also been increased. The conditions now put it up to the manufacturers to produce a recording device without extreme refinement, but which is cheap and will stay accurate, otherwise a meter cannot be used with small customers.

C. G. Durfee spoke of the value of the meter exhibit, and expressed the opinion that every operating company should send a meter man to the convention.

F. V. Magalhes referred to the importance of the code, and the legal aspects of metering and G. A. Sawin, in closing the discussion, asked all interested to help the committee in keeping track of all new apparatus which appears. The necessity for a cheap meter had been taken up with the manufacturers by the committee, but there was no relief in sight.

FUSE TESTING.

This was followed by a paper on "Use of the Oscillograph in Fuse Testing," by Alexander Maxwell.

The paper discussed conditions affecting the operation of enclosed fuses under short circuit conditions, pointed out the value of the oscillograph in the investigation, and presented some results obtained with this instrument. The fuses were of the all-porcelain (Murray) type and were tested under conditions as severe as are encountered in central-station switchboards. The test showed that the current and the energy expended in the fuse-chamber varied widely. There is a rough relation between the maximum instantaneous power and the resistance of the circuit, the power increasing where the resistance is lowered. For 100-ampere fuses, the time required for operation varied from 0.004 to 0.095 second, without any apparent relation to the constants of the circuits. The tests indicate that the constants of the testing circuit have an important bearing on the results, and the resistance is not the only important factor. Storage batteries were used in most of the tests. When inductance was introduced in the circuit, the maximum current and power were reduced, and the time increased.

There was no discussion.

SPACE ECONOMY OF STEAM TURBINE.

A paper with this title was presented by P. M. Lincoln.

In this brief paper Mr. Lincoln called attention in a striking manner to the small space required by steam turbine units as compared with reciprocating engine units of equal rating. This economy of space results from the compactness of the high-speed generator as well as from that of the prime mover. A number of diagrams were shown in which this was clearly demonstrated. A number of plants were cited that had been enlarged to double or three times

the original capacity by installing turbo-generating units in out-of-the-way places without enlarging the building. In several cases the installation of exhaust-steam turbines has accomplished not only this but even without an increase of boiler power.

METHODS OF DERIVING THE NEUTRAL.

The next paper was by J. R. Werth, Jr., and was entitled "Methods of Deriving the Neutral for Direct-Current Three-Wire Systems."

In this paper Mr. Werth describes the methods of deriving the neutral in the five most common ways of developing direct current on the three-wire system. In the first of these where a three-wire generator with collector rings and compensator is used, the compensator is a single-winding transformer connected to two points on the armature 180 degrees apart, with the neutral connected to the middle point of the compensator. If the neutral carries as much as twenty-five per cent of full-load current an unbalance of two per cent may result in voltage, which may require an auxiliary booster to compensate for, because of the inability to shift the neutral with this type of machine. The second method, using a three-wire generator with the compensating winding imbedded as an auxiliary armature winding, has the middle point of this winding connected to the neutral through a single collector ring. It is not used so extensively. In the third method, employing a two-wire generator with a motor-generator balancer set, the neutral is connected between the two machines of the balancer which operate in series. Since commutating poles are now generally used, balancer sets operate much more reliably. The fourth method with two generators in series and the neutral connected between them is, of course, the simplest method, though it entails additional floor space and requires more attention. The fifth method, involving the use of rotary converters, permits connection of the neutral from the middle point of the Y-connected secondaries of the step-down transformers. In this case it is desirable to distribute the winding in such a manner that the current flowing in any one leg of the transformer windings will affect the core of two of the legs.

In conclusion the author also states that the design of the exact apparatus to be used depends on the amount of unbalanced current to be handled and the necessity for shifting the neutral to compensate for inequalities in the copper drop between the two sides of the system.

C. W. Stone discussed the connections of transformers used with rotary converters for deriving the neutral, and pointed out that the double T connection may often be used to advantage. With three-wire machines the drop in the neutral itself must be compensated for, and this is often overlooked.

R. D. Donaldson asked why grounding switches were sometimes installed between both transformer neutral and neutral wire of direct-current systems. Mr. Werth replied that both switches were not used at once, but it is sometimes contemplated that balancer sets and three-wire machines will operate on the same system, but not at the same time.

GAS ENGINES.

The Report of the Committee on Gas Engines was presented by I. E. Moultrop.

The committee devoted its attention chiefly to installations operating on city gas and to the smaller gas producer installations driving electric generators. Design of gas engines and experiences of users were considered by former committees. More gas engines are used for other power purposes than for driving electric generators. A list of gas producer installations is appended to the report.

Discussion of this report was deferred until after the reading, by Walter Robbins, of the paper prepared by Nisbet Latta on "Adaptation of Gas Power for Central-Station Service."

At the beginning of Mr. Latta's paper he calls attention very forcibly to the rapid increase in fuel consumption in this country and the enormous waste which attends it. Of the coal fired in coke ovens about fifty per cent is wasted as volatile matter that is allowed to escape to the actual detriment of the community instead of being utilized. In our large cities likewise the smoke represents not only a fuel loss but a positive economic nuisance on account of the destruction, extra cleaning, etc., entailed by it. The annual loss from smoke is estimated at $500,000,000 a year. The logical outcome would seem to be the generation of electrical power at the mines by internal-combustion engines. The author believes that the net economy of the exhaust steam turbine has been overstated by enthusiasts. The gas plant is an ideal one where a variable readiness-to-serve capacity is essential. Under variable load the gas engines can be operated with some of their cylinders cut out of service, or "dead-headed." Mr. Latta makes a series of calculations to show the superior ultimate economy of a gas installation over a steam plant of equal capacity. He assumes an increase of twenty-five per cent in the investment charge for the gas engine plant over the steam-engine plant and a decrease of twenty per cent in their respective operating costs. From this he shows that at the end of the fifteenth year the annual saving in operating cost, plus interest on this saving has more than wiped out the initial difference in installation cost. From the satisfactory performance of gas engines in several steel plants the author concludes that the reliability of the gas engine has been fully established.

E. D. Dreyfuss opened the discussion by stating that the development of power at coke ovens for transmission was already being accomplished at Lebanon, Pa., where three 750-kilowatt gas-engine-driven units were delivering current to a point ten miles distant. Such a plant is very simple, consisting only of prime movers, without gas producers.

Irregularity of gas supply, from a variable demand for coke, is compensated for by using a 250,000-cubic-foot holder. He also considered the benefits of the low-pressure turbine to have been understated, since gains of twenty-five per cent had been demonstrated in condensing plants and fifty per cent or better in non-condensing plants.

H. W. Peck was disappointed in the report of the committee, as he was one of those who had supplied data and hoped to get something out of it. He cited three cases where gas-engine plants had been installed upon basis of statements of results to be obtained, but in every case the results were lacking and power could have been purchased more cheaply from the central station. The publications of the Geological Survey have been helpful in supplying data to convince customers on this point, since the statements of the gas-engine salesmen do not represent average conditions.

C. W. Stone could not agree with the figures and conclusions of Mr. Latta, and advocated saving the transportation of coal (and ashes) by locating the power plant at the coal mine, or else making gas at the mine and piping it.

E. J. Condon related a harrowing tale of his experience with a gas-producer plant. He was led to believe that $75 per horsepower would cover installation, but found the cost to be double that.

MODERN TRANSFORMERS.

E. G. Reed then presented the closing paper on "Interesting Points About Modern Transformers."

Mr. Reed discussed many of the points of modern transformer construction such as the magnetic circuit, impregnation, and methods of cooling. It was shown that the core type of construction was preferable for high

voltage transformers of small or moderate capacity, but that the shell type had advantages where the proportion of copper was large, as with low voltages or very high capacities. Burn-outs were discussed, and it is found that most burn-outs come from overloading. A lesser number become short-circuited from moisture.

PROTECTION FROM LIGHTNING.

The third technical session was held on Thursday afternoon and opened with the Report of the Committee on Protection from Lightning and other Static Disturbances. In the absence of the chairman this was presented by H. B. Gear of Chicago.

The committee on protection from lightning had secured over 500 reports from operating companies relative to the character of the protection made use of by them and the results achieved. The general trend of these reports, particularly as compared with the reports of previous committees, showed a steady improvement in the value of protective apparatus. In regard to distributing systems it has been found that the damage to apparatus has been confined mostly to the smaller transformers and meters. The extent of injuries reported is considerably less than in former years, partly due to the more general use of arrester equipment and also to a reduction in the number of severe storms in 1909. The success met with driven pipe grounds seems to be bringing these into more frequent use. The spacing of outside arresters on distributing lines varies with the more progressive companies from 1,000 to 4,000 feet, depending on local conditions. The failures of station apparatus have become even less frequent than in 1908. In regard to transmission lines, these seem to be particularly free from the troubles of a few years ago. The expense of distributing arresters all along the lines being prohibitive, they are seldom so placed. The overhead grounded wire where carefully installed, has been found effective in reducing line troubles. The value of choke coils has not been clearly demonstrated, but indications point to their efficacy. Electrolytic lightning arresters have come into more general use and seem to meet with growing favor.

The principal recommendations of the committee are as follows. Distributing systems; pipe grounds of ten feet length driven to have about six inches exposed are preferred to plate grounds. Arresters should be located so as to protect station apparatus, underground cables and line transformers; generally arresters should be spaced about 2,000 feet apart and closer together at exposed points. Careful records of each and every disturbance on the system, together with the losses of apparatus and interruptions to service, should be kept; typical forms for these are submitted in the report; tell-tale papers are recommended as a check on the operation of protective apparatus. Frequent inspections are needed to keep this apparatus in working order. Transmission systems; at stations the value of placing several types of lightning arresters in multiple has been demonstrated; for instance, multigap arresters for ordinary disturbances and horngaps for surges. Detailed records of the performance of each type of protective apparatus and of the disturbances caused on the system from all causes are highly desirable; blank forms for these are also submitted and described in detail. For line protection against insulator failures the overhead grounded wire is especially recommended; this should be a steel cable strung well above the center of the operating lines; on tower lines this should be grounded at each tower; on pole lines at least every 200 or 300 feet; for this purpose pipe grounds are recommended; at each grounded point some form of lightning rod should extend several feet above the grounded wire.

This report was discussed by Messrs. Steinmetz, Scott and Ryerson. C. P. Steinmetz considered the value of the choke oil, and pointed out incidentally that it might increase or decrease the danger according to its location. The action of a choke coil in protecting apparatus is effective when the coil is between the apparatus and the origin of the disturbance. If, however, the apparatus is between the choke coil and the origin, the coil will increase the danger, since it prevents the disturbance from diffusing into the line. The coil is most effective when there is an arrester on each side of it. The coil should be no larger than necessary. The promiscuous use of choke coils, especially of large sizes, is very questionable.

W. N. Ryerson spoke of the desirability of keeping records, and mentioned an automatic apparatus for registering discharges.

C. F. Scott described an installation in the west where complete records are kept. Written discussion was also submitted by R. P. Jackson and P. H. Thomas. Prof. Jackson has demonstrated by laboratory experiments the action of choke coils, but it is now a question whether the same money cannot be better expended in extra insulation of the end turns of the transformers. Little is gained in using over 0.04 henry, and the voltage drop should not exceed one-half of one per cent. Mr. Thomas considered that choke coils chosen haphazard were of little value, but their constants should be fixed with relation to conditions of service.

SWITCHBOARD PRACTICE.

S. Q. Hayes followed with a paper on "European and American Switchboard Practice" in which comparisons were made of the underlying principles of design and their results.

Severe competition in Europe has resulted in great similarity of design in the various countries, based on cheap labor and minimum of material. More precautions are taken, however, to safeguard station attendants and elaborate interlocks are used. Switching gear frequently occupies more space and installation is more costly on this account. In United States designs are usually based on best possible apparatus rather than cheapest. The Brusio plant at Campocologno in the Italian Alps and the Castel-Nuovo plant in Northern Italy were described as typical and views were shown of these and of some Siemens-Schuckert installations. Typical American boards were illustrated and described for contrast. Circuit breakers were given especial attention.

VOLTAGE REGULATION.

F. W. Shackelford described methods for and showed the necessity of "Voltage Control of Generators and Feeder Systems."

Heavy swings in voltage caused by fluctuating power and railway loads can be taken care of only by an automatic regulator, and even with purely lighting load hand regulation is an exceedingly hard matter. Various forms of regulators were considered, especially the Tyrrill type, for voltage control of the generator. Figures were given for decreased life of lamps on high voltage and decreased use of power on low voltage to demonstrate the advantage of regulation. Feeder circuits were then considered, and the use of variable ratio transformer was stated to be the only method of regulation which has given satisfaction. A switch type and an induction type of automatic regulator were then described, the latter being operated by a motor whose circuit is closed through a relay actuated by a contact-making voltmeter.

In the discussion, P. M. Lincoln pointed out the fallacy of the argument for regulation. The author might as well have contended that low voltage would increase life of lamps and high voltage increase power consumption and hence both be advantageous. With the cost figures given, an increased voltage would be advantageous in this particular case. The speed of different regulators does not depend so much upon the type of regulator as upon the method of driving it, and a rapid mechanism may be put on the induction type as well as any other. It is easy with any regulator to get a speed that will overshoot, requiring it to drift back again.

C. P. Steinmetz also made some remarks concerning speed of operation and overshooting.

SINGLE-PHASE POTENTIAL REGULATORS.

E. E. Lehr followed with a paper on "Modern Single-Phase Potential Regulators."

Step-by-step and induction regulators were described. The advantages of the induction type are lack of contacts which burn and need repairing and lack of limited number of definite points, and its disadvantages, as often claimed, are noisy operation, high magnetizing current, and large inertia of moving element. These objectionable features can be eliminated by proper design. Magnetic balancing overcomes noise, distributed windings avoid excessive magnetizing current, and it was shown that the kinetic energy of the moving part was only one thousandth that of the operating motor. A description was given of a regulator of the latest design. Oscillograms were shown indicating the time which elapsed between closing of the relay and starting of the motor; also between opening of relay and stopping of motor.

In the discussion, L. T. Robinson recommended uniformity in the making of oscillograph records, so that arrows should always represent progress of time. P. M. Lincoln emphasized the fact that the kinetic energy of the moving part had no influence on over-reaching. Quickness of action could be secured with any type of regulator by using clutches with a steadily running motor, whereas if the motor were started and stopped, it was the energy of the motor which came into play.

WATER INTAKES.

In a paper on "Water Intakes from the Mississippi River for Two Electric Generating Stations in St. Louis," John Hunter described the equipment of the condenser circulating systems of the two power stations of the Union Electric Light and Power Company at St. Louis.

INSTRUMENT TRANSFORMERS.

The concluding paper of the session was on "Precautions when Using Instrument Transformers," by L. T. Robinson.

In electrical measurements involving large alternating currents or high voltages, it is usual to employ instrument transformers for convenience, safety and accuracy. For safety, insulation must be adequate and secondaries should be grounded. Since size and cost increase rapidly with insulation while accuracy is made more difficult, there is always a temptation to limit the insulation.

Large capacity instruments, used directly on the circuit, may have large inherent errors, and instrument transformers, if properly used, will often give better accuracy. If improperly used, however, the transformer may introduce an error of six or seven per cent.

If measurements of ratio and phase-angle have been made under various conditions of load, corrections may be made to readings of indicating instruments in any particular case, but with watthour-meters this cannot be done, except for an average error, and it is then especially desirable to have transformers with good inherent regulation.

Curves were given showing the results of tests on various transformers with different loads. The author concludes that instrument transformers should not be employed without accurate knowledge of their performance under the actual conditions of use. Such knowledge may usually be obtained with sufficient accuracy from average curves of the type used, supplemented by points checked on the transformer used. Transformers can be procured which will give accurate results even on low power-factor.

C. G. Durfee inquired whether meters and transformers could be used interchangeably. Formerly the two were numbered to correspond, but the makers no longer do this. In reply, Mr. Robinson stated that, barring accidents, transformers were permanent and the transformer and meter are best regarded as separate units. Within one-half of one per cent no differences will be found in the same type of transformer, and they are therefore interchangeable.

Power Transmission Section Session.

On Thursday morning a meeting was held to form a new section on Power Transmission and a program was arranged with papers relating to this general subject. F. M. Tait presided over this meeting and as considerable enthusiasm was aroused, steps were taken to organize. Before adjournment, W. B. Jackson read the report of the committee on organization, which included the nomination of the following officers: President, H. L. Doherty; vice-presidents, J. R. McKee, H. H. Sinclair, R. M. Wilson; secretary, D. B. Rushmore; treasurer, P. M. Lincoln; executive committee, above officers and J. E. Montague, F. Osgood, W. N. Ryerson, W. H. Blood, Jr., J. F. Vaughan, F. B. H. Paine, C. D. Sprong, H. M. Byllesby, J. A. Britton, B. E. Morrow, D. L. Huntington.

On motions by E. J. Condon and F. Osgood, the report was adopted and the vice-chairman instructed to cast a ballot for the nominees who were thereupon declared elected.

The opening paper of the session was "Present Problems in Power Transmission" by H. W. Buck, in whose absence the paper was abstracted by D. B. Rushmore.

SOME PROBLEMS IN POWER TRANSMISSION

The evolution of long-distance transmission has been so rapid that a number of difficulties have been encountered that have not yet been satisfactorily solved. A discussion of them forms the bulk of Mr. Buck's paper. The use of steel towers is rapidly extending, as they permit longer spans and therefore a reduction in the number of towers and a diminution of insulator troubles. If the steel legs of a tower are installed directly in the ground, it is questionable whether their life will be longer than that of a wooden pole. Therefore, concrete foundations are advisable where the importance of this line warrants the extra expenditure. The economical length of span ranges from a minimum of 300 feet to a maximum of 750 feet, depending on a variety of conditions. With increase of length of span has come greater sag and to avoid this has necessitated much greater care in putting up the lines. The increased mechanical stress on the cables has introduced new mechanical problems in insulator and crossarm designs. Up to 60,000 volts the standard type of pin insulator gives satisfactory results. The cost of this type of insulator increases as the cube of increase in voltage above 60,000. The suspension type of insulator is practically standard for voltages above this. With the suspension insulator, however, the installation of the conductors is more difficult. At about every mile and at angles deadened insulators should be used to which the line is firmly tied. At intermediate towers a flexible clamping is desirable. The recent 100,000-volt lines have been more free from insulator troubles than the early 20,000-volt lines. It is probable that 100,000 to 110,000 volts is as high as is justified on a large commercial scale at the present time, as line voltage in excess of this calls for extraordinary expenditures. The regulation of these high-voltage lines has not been very satisfactory. It seems that the installation of shunt inductances along the line may be necessary to neutralize the capacity. The electrolytic lightning arrester has shown its ability to handle voltage surges but is not capable of dealing with persistent dynamic current at excess voltage. Lightning troubles on transmission lines have become less serious. The overhead ground wire has proved effective as a preventive measure. Mr. Buck concludes with a prediction that the development of high-tension direct-current transmission will open a wide field of possibilities.

This was followed by "The Public and the Water Powers," by Henry L. Doherty.

The conservation of our natural resources will be best promoted by developing our water powers as rapidly as possible, and thus sparing the consumption of fuel. Rights of eminent domain should be given to water power projects and both state and national governments should remove unnecessary obstacles. Our coal cannot be reproduced, and it represents not only latent power, but may be regarded as an immense store of fertilizer. The Mond process of gas-making yields twenty pounds of ammonia per ton of coal, and used as a fertilizer this will increase the value of a farm crop by about two dollars, or more than the cost of the original bituminous coal. Probably one billion dollars is expended each year in this country for fuel for power purposes, and not one per cent of the fuel is used in a way to conserve the nitrogen. Our water powers are capable of replacing all this coal, and saving it for other purposes. There is no other available source of nitrogen except by using electric power, and this is too expensive when obtained through steam generation. Argentine Republic has already surpassed us in exportation of farm products, and with the present rate of production and home consumption we shall soon be importing food. Unfortunately our whole conservation movement became embodied in the personality of one man, and those who could not agree with his intolerant opinions have been denounced as traitors to the public cause. A busy public applaud and support the movement in spite of the methods used, and in spite of this policy of restricting the true conservation of our fuel supply. The utilization of our water powers has been made possible by the inventor, the engineer and the financier. Innumerable sites remain undeveloped and failed to attract capital even without restrictions. While Canada and Mexico offer encouragement to such developments, great obstacles have been placed in the way in this country. It is an easy matter to retard development, but a difficult matter to create it, and the government should lend encouragement instead of retarding the object sought.

The discussion was opened by J. R. McKee who pointed out the unfortunate legal situation which exists on account of the lack of adequate laws governing the taking up and use of water power sites. A number of bills are now pending in congress, but few if any of these show any adequate appreciation of the needs of the situation. Even the developments which have been made in the past on the public domain have been made under mere operating permits with the understanding that the government would do nothing to endanger the investments made. Yet, the government had withdrawn such permits from operating companies and left them without any legal rights to guarantee their permanency. The result was that it was impossible to obtain any capital from investors either to inaugurate new projects or to extend existing enterprises. The whole matter is at present up in the air from a legal point of view and from the investor's point of view, and until adequate legislation is secured nothing can be done, since it is impossible to enter any action against Federal officers, as representing the government of the United States, which cannot be haled into court.

C. P. Steinmetz blamed the engineers and others interested, rather than the public and the public officials, for the ignorance of the latter upon the subject, and pointed out that there was a popular fear that valuable rights would be given away without proper protection to the public interests, or proper provision for government regulation. Under these conditions delay was more ap-

propriate than hasty action, and a deep study of the question from all sides should give a satisfactory solution. Personally he had not made this study and had no solution to offer. It was necessary however that public rights should be safeguarded, and the granting of rights to private interests in perpetuity was properly withheld until a proper basis of operation was agreed upon.

W. B. Jackson stated that there is a very erroneous understanding of the matter of water power amongst the people of the United States, and made a plea for the education of the public. It is impossible today to find a logical, intelligent and judicial consideration of the question.

Irving Hale said the West was for conservation in the true sense, and spoke of the difference in the legal status of the water question in the West and in the East. The doctrine of riparian rights could not be applied in the West, and the rule was adopted that the water belonged to those who used it, and not to the adjacent land owners. Now the federal government, while admitting that the water belongs to the people of the states, wants to control it because it owns the land; in other words, is adopting a principle that does not hold in the case of individual owners. The water power trust is a bogie set up to gain popular support. Coal and timber can be conserved only by restricting their use; water power can be conserved only by using it as freely as possible. The trouble has not been to prevent the water powers from falling into the hands of a trust, but to induce capital to develop these enterprises, and it is a misfortune to have obstacles thrown in the way.

C. F. Scott held that engineering is leading legal development. Power transmission is new and the laws are antiquated. The relation between private and public ownership and rights is involved. Today government control of public service corporations is endorsed by most of those at the meeting. This was a radical position ten years ago, and it shows a change in attitude. The public is concerned more with the moral than the legal rights, and wants to see the water powers developed in accordance with those rights. The fundamental problem is to shape our laws and policies so as to give a proper general solution. The speaker, like Dr. Steinmetz, was in general sympathy with the aims of Mr. Pinchot. He has done a great work and has stood for a right principle and a right general policy even though each specific minor act may not have been right.

D. B. Rushmore thought that this meeting should mark the beginning of a constructive policy, and D. H. McDougall told of Canadian experience with franchises at Niagara Falls, where franchises are for ninety-nine years, rents to be adjusted every thirty-three years, and the government puts a limit on rates.

HIGH POTENTIAL LINE PHENOMENA.

This subject was treated by C. P. Steinmetz in a popular way, the object being to make clear the conditions existing on such lines and the causes of the phenomena observed.

HIGH-VOLTAGE TRANSFORMERS.

The final paper of the session was by K. C. Randall on "Some Points in the Construction and Operation of High Tension Transformers."

Air-blast transformers cannot be so well insulated as the oil types and are not used above 40,000 volts. The capacity of self-cooling transformers has been raised by the use of boiler tubes connected to the top and bottom of the tank outside, providing thus for circulation and cooling of oil. The drying and testing of transformer oil, effects of short-circuit currents, parallel operation, and shipment were also given consideration.

Anniversary Session.

The anniversary session of the National Electric Light Association was held on Wednesday evening, May 25, the meeting being called to order at 8:30 o'clock by President Frueauff, who introduced E. A. Sperry, who read a paper entitled "The Founding of the Association in 1885." Mr. Sperry's paper recalled many interesting incidents relative to the first meeting of the association, a full report of which, taken from the ELECTRICAL REVIEW of March 7, 1885, appeared in the issue of May 21, 1910, of this journal. In this connection it may be pointed out that the convention of February 25, 1885, was not called to order by George S. Bowen, as stated by Mr. Sperry, that honor falling to William A. Hovey, of New York.

Letters and telegrams were read by Secretary Martin from J. Frank Morrison, first president of the Association; Edwin R. Weeks, Thomas A. Edison, L. B. Stillwell, president of the American Institute of Electrical Engineers; Edward Weston, Elihu Thomson and James E. Davidson.

Mr. Sperry's presentation aroused the enthusiasm of the gathering, and the president then called upon Charles W. Price to stand up and acknowledge himself as one of the group that had formed the Association.

The tumult was redoubled when Samuel Insull, president of the Commonwealth Edison Company, of Chicago, Ill., was hailed as the dean of the profession, and called upon for his address, entitled, "Twenty-five Years of Central Station Commercial Development." Mr. Insull said, in part:

TWENTY-FIVE YEARS OF CENTRAL STATION COMMERCIAL DEVELOPMENT.

It is an especial honor, which I very much appreciate, to be given the opportunity of addressing you on so notable an occasion as the celebration of the twenty-fifth anniversary of the starting of this association. To those of us who have been in the central station business since its inception it hardly seems possible that twenty-five years have passed since the organization of the association in Chicago on February 3, 1885. If, however, we reflect on what has been accomplished in that time and recall that at our first meeting our membership was only seventy-one, whereas, if I am correctly informed, it is at the present time 5,369, we would seem to have occupied about the allotted time in our growth from birth to that of a young but sturdy manhood. The organization was originally started more in the interests of the electric manufacturers than in the interests of the central station companies.

In 1885, when the National Electric Light Association was formed, the development of the central station business was confined almost entirely to a few companies established under the auspices of the Edison Electric Light Company. The companies forming our early membership were not engaged in what we understand today as central station business but were either arc light manufacturers and supply men or those companies who were engaged in series arc lighting, doing practically no other business, except in a very few cases, a small amount of power and series incandescent business.

At the Niagara Falls meeting, in 1897, I well remember the paper read by my friend T. Commerford Martin, on the "Daylight Work of Central Stations." He started his paper by stating that the central station industry had in some respects been a disappointment; that after nearly twenty years of work the companies restricted themselves injuriously, by remaining mere lighting companies, and he asked the question what would become of the central station companies if a new lighting medium came into vogue and we were deprived of our illuminating business entirely.

To get statistics of the early days of the business is a difficult matter, but Mr. Martin on the same occasion showed that in 1886 there were 410 central stations in the country; that only 300 of these furnished any statistics and that of those 300 two hundred and twenty-six were only doing a night business.

Assuming, as Mr. Martin did, that those who did not report were in the same class as the 226 doing only a night business, we find that out of 410 so-called central station companies 325 were doing business only between dusk and daylight.

From these figures I should judge that at the time of the starting of the National Electric Light Association in 1885, there were not more than eighty companies engaged in serious central station business, that is, in selling electrical energy for all kinds of purposes every hour of the twenty-four, whereas today there are probably upwards of 6,000 central station companies in the United States. It is probable that to say $10,000,000 represented the cash investment in the business in 1885, is naming a very liberal amount, whereas it is authoritatively stated that between $1,000,000,000 and $1,250,000,000 represents the total sum of the capital employed today in the central station industry of this country.

The first commercial central station plant erected anywhere was that installed by the Edison Electric Illuminating Company of New York. It occupied a territory about a mile square, extending as far south as Wall street. The station was located on Pearl street one or two doors south of Fulton street. The system employed was the Edison two-wire main and feeder system.

It was started September 4, 1882. Some time after the construction of the New York plant had started, a small central station plant, of only 250 sixteen-candle power incandescent lamps, driven by water power, was projected at Appleton, Wisconsin. The Appleton plant was started on August 20, 1882, just two weeks before the New York plant was put into operation; so that, judging by the date on which the first commercial plant was put in operation, while New York can claim the credit of projecting the first central station system, Appleton, Wisconsin, in the heart of the Central West, can claim the credit of putting into operation the first commercial central station and to have inaugurated a business which in less than three decades has grown from nothing to an investment in this country alone which can only be expressed in ten figures.

The commercial development of the business was of necessity, in the early days, hampered, amongst other things not only by a lack of knowledge of conditions governing the relation of the true methods of selling electric energy to the cost of producing it, but also by the high capital cost of the plant used; although it might be well to state that the first million dollars invested in the central station business was that provided by the local Edison company in New York, whose plant was put in service in September, 1882, and this first capital showed substantial earning capacity, and I believe paid dividends before additional capital was raised by the company. But what could be done under the favorable conditions existing in New York could not be done elsewhere, and the commercial development had to await the efforts of the inventors in the direction of reducing first cost. It is not my purpose tonight to detail the marvellously successful work of the many brilliant inventors whose efforts following Edison's original invention of the central station system, have contributed so much to the success of our business. I shall but mention what occurs to me as the leading features which, from the technical and engineering side have made the central station business of today possible. The change from the two-wire system to the three-wire system, saving sixty-six and two-thirds per cent of the copper necessary in distribution and the reduction in the energy consumed by the incandescent lamp from six and one-half watts per candle in 1882 to three and one-tenth watts per candle in 1890 made the central station business a certain financial success in cities of the first, second and third rank; and the introduction of the alternating current system, first established in this country at Greenburg, Pa., in 1886, by the Westinghouse Company, made the central station business available for the small towns throughout the country. The building in 1890-1891 of slow-speed electric generators directly connected to highly economical reciprocating engines, usually of the vertical type, was the first step in the direction of reducing first cost of central station investment, and also in reducing the operating cost of the energy produced. This made possible, and was followed in 1896 by the introduction into this country of the use of high-tension alternating transmission lines operating substations, in which were installed rotary or stationary transformers, depending on whether direct or alternating current was to be distributed therefrom. The combination of the direct connected dynamo engine unit of high efficiency, the high tension transmission lines and substations, forced, on account of the saving made, the abandonment of small generating stations and the massing of production on a very large scale. The limit of the size of units of power was reached by reciprocating engine at about 5,000 horsepower, and the demand sprang up as the volume of energy produced increased, partly from centralizing production and partly from increased business, for prime movers of greater size, lower investment cost and lower operating cost; resulting in the development of very large steam turbo-generators, which operate today in units of upwards of 20,000 horsepower, and which will within the next year be operating in units of 30,000 horsepower. Within the last two years the introduction of higher efficiency incandescent lamps, such as the tungsten lamp, has greatly reduced the cost of light.

In the early days of the development of the central station business, from, say for the first ten years of its existence, from 1881 to 1891, the customers of the central station companies looked upon our product as more or less of a luxury. Partly owing to a lack of knowledge of the conditions governing the relation of cost and selling price and partly owing to the difficulty of getting our customers to make the necessary investment to connect with our system, our service was used rather as a luxury, or as an advertising proposition than as a necessity. In the early days of the business rates were very high, corresponding about to gas at two dollars per thousand feet. The discounts from these rates were very small and most large consumers of electric energy, even within the area served by a central station system, found it to their advantage to install their own plants and manufacture their own electric energy. The result to the central station company was that the central station business was confined almost entirely to short-hour consumers, the consequence being that the investment of the central station company was in use but a very few hours out of the twenty-four, the interest cost to the company being necessarily very high and the operating cost correspondingly high. It was not until the early nineties that any of the managers of the large central station properties of the country appreciated the fact that if they desired to place their business on the basis of a general public necessity it was necessary for them to rearrange their rates on such a plan as would give the long-time consumer, the man who used the central station company's investment most steadily during the year, the lowest possible price; and the recognition of the necessity of meeting this condition may possibly have had as much to do with reducing operating cost and reducing interest and depreciation costs as have the wonderful work of the inventors and the marvelous skill of the engineers.

It would have been of very little use to the central station manager to have been able to take advantage of the large units produced by the manufacturers for the production of energy or of the economies introduced in the distribution systems by the introduction of high-potential alternating currents and transformer substations, if the methods of charging for service had not broken away from the plan on which the business was originally started. If you will take the statistics of any of the central station companies, whether they be large or small, and look for the reasons for the enormously rapid growth of the central station properties of the country, you will, I am confident, find that the rapid increase in the amount of energy sold responds absolutely to the putting into use of liberal methods of dealing with the company's customers.

I am dwelling upon this subject not with any idea of belittling the great achievements of the inventors and engineers whom it has been our good fortune to have had working in our interests in the fields of discovery and engineering, but for the purpose of impressing, more especially upon the younger men connected with our organization, the great importance of the commercial side of the business and to point out to them the advantage alike to themselves and the business itself of their bestowing upon the commercial side of the business as much, if not a greater amount of thought, than that which they bestow upon the technical operation and construction side of central station development.

To the young engineers engaged on the operating side of the business my advice is to familiarize themselves with the commercial conditions under which the companies for which they work have to conduct their business. If they will give thought to the commercial side of the business and qualify themselves to take part in the sale of the product of the company, if they will devise new methods of selling the product, new methods for obtaining consumers of the energy produced by the central station they will stand a chance of achieving distinction and profit far greater than most of them can achieve in the operating and purely engineering side of the business.

The possibilities of central station business, while great today, must be far greater in the future, and in trying to point to what those possibilities are it might not be amiss to discuss what is the real function of a central station company. Is it simply to light the streets of the city, as most of the electric lighting companies thought was their function twenty-five years ago? Is it merely to do house to house lighting, as was (with the incidental power connected with it) the business inaugurated by the few Edison companies a little more than twenty-five years ago? Should a central station company be engaged merely in production of power for industrial purposes, or for railway purposes—whether the railway be urban, interurban, state or interstate? Or should the central station company embrace all of the functions stated above and produce all of the electric energy needed in a given community or a given area?

The maximum load of the electric lighting business in this latitude comes in December and is accentuated by the industrial power load; the maximum load of the street railway business comes more often in January than in December, especially in the central west, owing to the conditions of temperature and consequently heating as well as traction. The maximum load of the steam railway business, so far as I have been able to figure it, comes in the middle of the summer in Connecticut and Massachusetts, towards the end of September around New York City and in October around Chicago and St. Louis. The maximum load of a waterworks comes in a great many instances, if ample storage is at an elevation, at the convenience of the producer; and in any event, it comes at a time of the year when the demand for total energy used in a given community for other purposes is by no means at its maximum.

Why should all these operations for the production of energy be dealt with on a separate basis? Why not concentrate them all, and by so doing get low cost of production, low capital investment (because of the elimination of duplication of investment), and increased diversity of demand for energy, and, what is of vast importance, consequent low prices to all users, whether they be the occupant of a simple cottage, spending fifteen or twenty dollars a year for light, or a large railway system using fifty or seventy-five thousand kilowatts of energy?

What I am advocating is merely the extension of the central station idea. It is applying the same principle, on a very large scale, which underlies our business, which is the advantage of increasing the diversity of the demand and increasing the quantity of the output.

If you will apply the arguments that you use to persuade a possible customer to give up his isolated plant to the larger questions of manufacturing and distributing electric

energy, you must come to the conclusion that our true function as central station companies is not only to supply the energy required in the community in which we live, but also to supply the energy required to carry us to the next community when we go to visit our neighbor, or in any case to carry us part way.

A few months ago the vice-president of the New York, New Haven & Hartford Railroad, appearing before one of the official bodies of Massachusetts, said that in his opinion, within the next fifteen years the New Haven road, between New York and Boston, would be electrified throughout, and the towns on the way would have the opportunity of obtaining electric energy at a very low cost, the cost dependent upon the cost to the railway company of current, which, in his opinion, would necessarily be low because of the very large amount of business that they would have of their own.

The work of the New York Central and Pennsylvania railroads in the way of electrification has gone hand in hand with the work of the New York, New Haven & Hartford Railroad, and if the steam railroad people look forward to current being supplied at very low cost throughout Connecticut, Massachusetts and Rhode Island as a result of the production of current in large quantities for the electrification of the steam railroads in those states, the same thing must necessarily happen throughout the whole of the densely settled portion of the United States, if the reasoning of the vice-president of the New York, New Haven & Hartford Railroad be correct.

But it would seem to me that our functions as producers of electric energy should, with the tendency towards electrification of steam railroads, become very much broadened; and instead of its being the exception, as it is today, for a central station company to cover any large amount of territory outside of the municipality in which they are mainly established, their operations will become far more extensive; as, if the steam railroad men of the country want electric energy produced economically they should find it to their advantage to come to us as specialists in the manufacture of electric energy, taking advantage of our experience in the best methods to pursue, taking advantage of combining their necessities for electric energy with the necessities existing in the communities in which we operate—which combination will result in economies which neither can obtain separately—and so leading to the establishment of large central station plants capable of supplying all the requirements in the way of electric energy for a large area of territory surrounding the centers of population. If our members will do their share towards working to such a desirable end the possibilities of electrification of steam railroads will be brought much nearer to us. The financial burden of making the change would be divided, the steam railroads providing the necessary capital for electrifying their right of way and changing their rolling stock, the central station companies of the country providing the capital for building the large generating stations and transmission lines to convey the electric energy to the railroads and other consumers along their right of way.

Before closing my remarks I desire to refer to the relations which the central station business bear to the communities in which we operate. The business in which we are engaged can be most successfully operated as a monopoly business. If the communities which we serve are to get electric energy at the lowest possible cost, they can only expect to achieve this by preventing duplication of investment and by concentrating production under one organization. The fact that low prices cannot be permanently obtained by the old method of encouraging competition is being very generally recognized today, and as this becomes more and more recognized the regulation of our business, our methods of conducting it, our methods of financing will be subject more and more to governmental supervision in some form or another. This demand for supervision, while it certainly is a trend of the times, is also an appreciation on the part of the people of this country that the destructive effect of competition in public service business ultimately means greater burdens on the community through the maintenance of high rates to give a return on the excessive capital tied up as a result of duplication of plant. Fortunately for us, living as we do in a country having had tremendous development and capable of almost unlimited development in the future, this policy of competitive regulation has had a limited effect only, as the growth in the communities in which we operate and the fact that our business has by no means reached a point of saturation in the large and small cities of the country, has enabled us from increased business to absorb and bring into active use a great deal of the capital which during the period of competition seemed to be an unnecessary waste.

It should be borne in mind that the more closely our business is supervised and regulated the greater are the chances of our being protected against ruinous competition, which today is mainly instigated by those who desire to take this means of acquiring our existing business. Whilst we may not care to be hampered by the rules and regulations established by commissions created to watch over our operation, the further these commissions go into our business the more will they be convinced that the best results can be obtained only by regulated monopoly, and that competition is alike as ruinous in the long run to our customers as it is to the central station company itself. The result will be that our monopoly of the business will be secured, our securities will stand in higher credit and new capital will come flowing into our coffers for the extension of our business. I do not myself view with any alarm the proper regulation of the business in which we are engaged, but feel that its stability may be greatly increased thereby.

There is another phase of our relations with the community which all of us should do our best to foster. I refer to a friendly feeling of relationship between the public service corporation and its customers. As a rule the tax collector is not supposed to be popular, and many people look upon payments which come regularly every month for the use of a public utility, more or less in the form of taxation; but I do think that it is possible for a central station manager, by liberal methods of dealing with his customers and by absolute fairness whenever there is a matter in dispute, to encourage a feeling of friendliness towards the corporation which will build up a valuable asset in the shape of good will. Unfortunately in the last few years there have been a number of people engaged in arousing a spirit of hostility to the corporate interests of the country. I do not refer alone to corporate interests running natural or artificial monopolies, as this agitation has been directed as much against the mercantile business run on a large scale in the form of a corporation as against the public utility corporations, whether they be municipal, state or interstate. A great many of the people engaged in this class of agitation have done it to serve their own particular ends; others, high-minded and honest citizens, have thought that the interests of the state were menaced by corporate monopolies and that only by agitation could these interests be preserved. But no little damage has been done to the corporate interests of this country by the action of some officials of corporations, who seem to have had more concern for the profit of the moment and little or no concern for the permanency of their investment in the future. We central station managers ought to look upon ourselves as semi-public officials and so conduct our affairs with the community as to give us the advantage of a reputation for absolutely fair and impartial dealing. We should preach the same doctrine to our subordinates and insist upon the same policy being carried out in their dealings with the public. If such a course is pursued we will not only be helping to improve the opinion of the community of corporations generally, but will be establishing our own business on so firm a basis as to add to the permanency of our investment and give promise of prosperity in the future.

Continuing, Mr. Insull spoke of his first experience with the electric lamp in connection with the installation on the Thames Embankment at London, and of his desire at that time and ever since to be associated in a useful way with the industry. He concluded with a strong appeal to the young men to look upon their chances for success in the central station field as of the highest possible opportunity.

The report of the Public Policy Committee was presented by W. W. Freeman, chairman.

Upon motion of Louis A. Ferguson, second by Farley Osgood, greetings of the association were extended to J. Frank Morrison and to Charles R. Huntley.

The meeting then resolved itself into an executive session of Class A members, when the nominating committee was appointed and the report of the secretary and treasurer, Frank M. Tait, was presented.

Mr. Tait called attention to one feature of the association work, namely, the tremendous volume of business handled by its New York office. The magnitude of this work is not realized by the average member. In the eight months ended May 1, 1910, no fewer than 10,899 letters were received in the office, and during the same period the letters sent out totaled 14,193. This does not include postal cards, only two-cent letters. It does not include any of the work done by various committees outside of the office, some of which were supplied as many as 1,600 sheets.

In addition it has issued the regular monthly bulletin amounting to over 5,000 copies each month, as well as 7,000 copies of the proceedings. Finally, during the present month and prior to this convention, 25,000 circulars and post cards were mailed and 1,500 sets of the convention papers have been put through, representing 1,600 pages of printed matter to each set. The association is to be congratulated upon having the efficient organization represented by Miss Billings, Mr. Martin and the office staff.

Mr. Tait then gave the figures showing the financial condition of the association, which, briefly summarized, are as follows:

On May 1, 1910—Cash in bank, $8,923.50; cash in assistant treasurer's office in New York, $300; total, $9,223.50. Investment fund — Commonwealth Edison Company bonds, $5,146.53; cash reserve fund in Old Colony Trust Company, Boston, $10,000; total, $15,146.53. Grand total, $24,370.03.

The meeting then adjourned.

Commercial Sessions.

The second commercial session was called to order by George Williams, vice-chairman, promptly at 2:30 p. m. and after making a few brief announcements the first paper on the programme, entitled "Central-Station Advertising," by Howard K. Mohr and C. W. Lee, was read by the latter.

CENTRAL-STATION ADVERTISING.

The paper constitutes a report based on replies received from central stations who were approached on the subject of central-station advertising.

During the past five years the central-station advertising field, as well as its methods, has undergone considerable change. We find a number of the companies who were the very first to advertise still sturdily maintaining, and even increasing, their yearly advertising expenditure. Many other companies, who five years ago emulated these same originators, have either ceased all systematic advertising or have entirely changed their ideas and methods. Several of the member companies have given as their answer to the question "What do you consider the best method of advertising?" "Good Service." This is a broad, general term, which applies not alone to the furnishing of current at the proper voltage, in the required quantity and with reasonable continuity; it applies not alone to the mechanical and electrical features of your business, but it refers in an even greater degree to commercial departments. Good service applies quite as much to the personal relations existing between the customer and the company as it does to the mechanical relations. Some of the answers state that soliciting, in their opinion, is the best advertising. These people seem to be under a misapprehension. They should realize that advertising is never advocated and is, in fact, useless without a properly organized soliciting department. The effect of advertising on the organization is another important aspect of the value of advertising. It has been an almost unvarying rule that, wherever a central station has started a sincere advertising campaign, this very advertising has led to permanent and invaluable reforms in the organization itself. The printed advertising bearing the name of the company invariably focuses the attention of officials and heads of departments upon the machinery of their organization. It never fails to call attention to faults of service and lack of organization facilities. The argument made by the average small central-station man that, "Of course, the larger companies will get results because they spend large sums of money for advertising," is only an excuse behind which to hide. The same methods employed by the small central station with a moderate expenditure can and will produce proportionate results.

The discussion on this paper was opened by L. D. Gibbs, of Boston, who said that for the smaller central stations the conditions for advertising are more nearly ideal than they are with a large station. The operators and the employes of the small stations come more forcibly in touch with the people; they are nearer to them; they see them more frequently, and the people, the consumers and others, feel that they get their messages back to headquarters more quickly in the small company and more certainly than they do in the big concerns. It is vitally important for the very central station to have loyal employes. Mr. Gibbs said that every man can be trained to appreciate the importance of this, and appreciate the advantage that he is getting out of it for himself. He emphasized the points made in the paper and explained a few of the methods employed by the Boston Edison Company. The Boston Edison Company interests the wiring contractors to co-operate with it and has an appropriation of kilowatt hours for the year for advertising purposes. Out of that appropriation is used the current to illuminate signs for electricians about the city and those signs are proving of value to them; they are educative as electric signs, and they keep the word electric before the people. Mr. Gibbs then spoke of the attitude of a central-station towards newspapers and enumerated the benefits to be derived from a liberal policy towards them. He also spoke of another form of work that has developed with the Boston Company called co-operative development plant.

F. D. Beardsley, of St. Louis, related a few of the methods pursued in St. Louis in an advertising way. He said the principal part of the St. Louis company's advertising is in the daily papers, and next to that would come the billboards and electric sign work. He said that billboard advertising in St. Louis gives excellent publicity. Those billboards are illuminated at night by having a reflector across the top of the boards so that they stand out and are very easily seen. The "kick signs," recently installed in St. Louis, were referred to and the results enumerated.

J. C. McQuiston, of Pittsburg, gave some statistics with reference to the users or possible users of electric current, and those outside of the territory where the current could be used. Assuming a population of ninety millions of people in the United States today, from the figures obtained it was assumed that a little more than half or approximately one-half of the people were out of the bounds of the electric current zones. Of those living in the territories where the current could be had it was found that perhaps ten per cent were using the current, and ninety per cent in the cities today not using electric current. An analysis of those figures showed that the smaller towns had by far the best report with reference to this matter, some showing sixty and seventy per cent of the people using electric current. Mr. McQuiston then spoke of what the manufacturer was doing for the central station in the matter of advertising.

Philip S. Dodd, of Cleveland, spoke of the relationship between the central station and the lamp manufacturer. He said that almost all of the lamp manufacturers of the country at the present time are in a position to supply the central stations with a series of advertising campaigns which are comprehensible enough to cover almost every phase of the local conditions. These campaigns have been prepared, not so much as advertisements for lamps, or for any particular type of lamp; they have been prepared to advertise electric light; they have been prepared so that they will be given out as individual advertising by the central station, with the central station's name on it. They cover almost every subject or problem that a central station might be confronted with. In places where the central stations are fighting gas, the manufacturers have material prepared that will cover that situation. They have got pretty nearly everything necessary and they are going to supply central stations with this.

The discussion was closed by Douglas Burnett, of Baltimore, who briefly outlined the policy of the Baltimore Company in regards to advertising.

The next paper presented was one by Hayden Eames, entitled "The Electric Vehicle Opportunity."

THE ELECTRIC VEHICLE.

This paper pointed out the wonderful possibilities of the electric vehicle for central stations, showing that in the city of New York if only one-half of the horse-drawn vehicles were substituted for electrics, the income from the current at four cents per kilowatt-hour would amount to $52,000,000 per year. The electric vehicle business has inherited a great many things from other businesses that are more or less analogous to it, but which are, by no means, exactly similar. The consequence is, if you act on impressions, you may get momentary advantage at the expense of ultimate success. During the fifteen years that the manufacturers have been engaged in pushing that business, they have had occasion to know what the real problem is. The assertion that business wagons have not improved in an engineering way in the last ten or fifteen years would not be true. They have improved, but the point that impresses one upon an investigation of the history of their improvement is that as long ago as ten years the power electric wagon had already reached the degree of economy that made it more economical than horses for all service—for all service within certain limits. It is because the people have failed to take the next step that it has been kept back all these years, and is still keeping it back. That seems to be the question that people not having anything to do with the electric vehicle do not seem to comprehend. Mr. Eames spoke at some length on the extreme measures necessary to educate the public in the use of electric vehicles and said that the bulk of this work would necessarily fall upon the central station. He also spoke at some length regarding wagon ratings. When central-station organizations have informed themselves on these questions, have recognized their great importance, and have made it their business to see that the first local power wagon shall be carefully bought and intelligently used, they will have made a long stride toward getting the benefit of this new market for current. These things are intangible, but, after all, the whole thing is mental, and these are mental problems, the solution of which will produce an immediate and tremendous demand for current for power wagons. To make this education effective, to be in a strong position to regulate local introduction, to see that a proper application of vehicles is made, to see that, for instance, electric wagons are not used where gasolene wagons would give better satisfaction, and vice versa, it is essential that central stations maintain a judicial position. While, no doubt, every manufac-

turer would be glad to have the direct aid of central stations in the local distribution of his vehicles, this could not fail to retard local educational work. It would undoubtedly stimulate large competitive interests to an active propaganda in favor of independent power stations, and these, in many cases, would be amply justified by the amount of power-wagon current required. Under existing conditions, the most healthy, strongest and most promising line of action for central stations will be to establish themselves as sources of information and to use the moral influence this will create to insure for their localities, always under their own tacit control and direction, the full benefit of the efforts of all competitive electric wagon manufacturers. He said that central stations must see that owners of electrics don't want to put in independent plants. Central stations are not dealing with people who are lighting single dwellings, but with people who use a great many electric units.

The discussion on this paper was opened by P. D. Wagner, of the General Vehicle Company, who said that one reason why the electric vehicle has not had the support of the central station has been because in the past, after the electric vehicle was sold, the purchaser was left to work out his own salvation, the result of which has been a dissatisfied customer. He said that there is an honest attempt on the part of all vehicle manufacturers today not to sell an electric vehicle unless they honestly believe that it is fitted to do the work. The vehicle manufacturers are also doing what, as a matter of interest was done in the early days of the electric lighting industry in New England. Mr. Wagner spoke of the current consumption by the electric vehicle and gave interesting statisties in this connection. He said that as regards Mr. Eames' paper, he has covered the subject so completely and so ably that there is very little to add. The proposition is strongly up to the central station. The manufacturer, naturally, is going to do everything that he can to market his product, but to steal Mr. Eames' phraseology, the pricipal beneficiary, the long-time beneficiary, is the central station, and there is absolutely no question but what the progress made in the business will be very nearly in proportion to the strength with which the central station gets behind the proposition.

William H. Blood, Jr., said that the electric vehicle business and the charging of storage batteries for them is today the best undeveloped prospective load in sight for the central station. Besides being a load of large proportion, it is an off-peak load. In other words, it enables you to sell your product which you have, or rather to sell your by-product under this arrangement. Mr. Blood outlined the scope of both the electric and gasoline vehicle. He explained the functions of the Electrical Vehicle and Central Station Association which has recently been formed in Boston and spoke of its future prospects. Mr. Blood also spoke of a co-operative movement on foot between vehicle manufacturers to extensively advertise the electric vehicle.

G. H. Jones, of Chicago, said that the Commonwealth Edison Company believes very heartily in the great future of the electric vehicle business. He said that in order to bring this matter before the people, the company is carrying on two forms of educational campaign. One, to bring the matter before the non-users, and the other to educate those who have machines, to operate them right.

Mr. Eames then closed the discussion by commending the points brought out by those who followed him.

DECORATIVE STREET LIGHTING.

The next paper to be presented was entitled "Decorative Street Lighting," by E. L. Elliott and in the absence of the author was read by Mr. Lansingh.

It is a most fortunate combination of circumstances that the field in which more light is most needed should also be the one in which good lighting will attract the most public attention. The lighting of the most frequented sections of a city affords an object lesson in illumination which is absolutely unsurpassed in conspicuousness and effect. A brilliantly lighted business street attracts people; they come out to see the lights, to see one another, and to see the window displays and signs along the way. Decorative street lighting is a public improvement which stimulates civic pride. It is something in which all citizens feel a special interest. It is, therefore, one of the most powerful means of creating favorable public sentiment toward a lighting company. There is no reason why the central station should not take the initiative in establishing better public lighting. Nine-tenths of the troubles which central stations have encountered at the hands of the public have been due to the fact that they have allowed the public to take them by default. Public sentiment is notoriously an uncertain quantity. It may run along without showing the slightest indication of change for years and then suddenly overflow its banks and carry everything with it. Decorative street lighting should include a city sign. By this is meant an electric sign carrying some motto or slogan intended to boom the town. The sign business is one that can be cultivated with an assurance that the results will please everybody. Signs raise the standard of illumination of the streets, add enormously to their attractiveness, and bring profits to those using them as well as to the central station. It is inevitable that even a small section well lighted will be the means of extending better lighting to other sections and in time throughout the entire city. Better street lighting as a public improvement is bound to be much talked of by the citizens. It gets them to thinking about the subject of light, and so puts their minds in a receptive state for any lighting proposition that may be presented to them, thus making it so much easier to secure the installation of better systems for interior use. While any kind of an installation is better than none, no effort should be spared to make an installation of such a character that it will serve as a public improvement, without either deteriorating mechanically or having its attractiveness wear off.

Following the reading of this paper the meeting was adjourned to convene again 10 a. m. Thursday.

THURSDAY MORNING SESSION.

The meeting on Thursday morning was called to order by Chairman Frueauff who called for the first paper on the programme, entitled, "The Organization and Functions of a Sales Department," by T. L. Jones of Brooklyn.

FUNCTIONS OF SALES DEPARTMENT.

Mr. Jones contends, at the outset of his paper, that the name sales department is more appropriate than commercial, contract or new business department. The head of the department should be called the general sales agent; sub-heads in charge of any district offices should be district sales agents, and the men in the field known as salesmen. All current-consuming apparatus sold or rented should be disposed of by the sales department. Displays, electric shops, shows, etc., should be conducted by the selling force. A live advertising manager is an essential to the organization of the department. The general sales agent should be big and broad enough to manage all the various lines of the department's activity. A family tree of the department's makeup should be drawn up so that each man knows who his superior is. Aside from the district sales agents and advertising manager, there should be immediately under the general sales agent a power engineer, an appliance manager and special salesmen for new buildings and municipal contracts. As a rule the salesmen in the field should be specialists, according to the work they are most capable of handling; thus there should be separate lighting, power, wiring and appliance solicitors. The advertising manager should also be the company's publicity director; he should establish close relations to the newspapers and be the press agent for all company news. Particular care is necessary in pleasing each customer. The most logical person to receive his complaints is the salesman who has solicited his business. Reports of the salesmen's work should be made out on detailed forms for future reference as to prospective business as well as to note what each man is doing. The most cordial co-operation must exist between the sales department and other departments of the company, for without this the sales department's work would be productive of little good.

E. W. Lloyd, of Chicago, opened the discussion of this paper. He said that while a sales department may have all to say relative to the handling of customers and the sale of energy, it can do little, unless it co-operates and works in harmony with all other department of the company.

Co-operation with the inspection department is very essential. The man from the inspection department, calling on the customers, has to treat the public very much as a salesman. Co-operation with the claim department, if not incorporated in the sales department, is also essential. In some companies the claim department comes under the head of its attorney. Complaint men are strictly office men, and being such, are not always qualified to handle the complaint as it should be handled. In such cases, referring to the power question, the Chicago Company makes a practice of sending out in addition to the investigator of the claim department, a man who is an engineer, who is qualified to pass on the customer's installation. In connection with the treasury department, collecting all bills, it is very necessary to have close co-operation. The treasury department has to make its showing, keeping down the number of bad debts, etc., and there are cases where the action of the collec-

tor has antagonized the public, and in such cases, the function of the sales department is to get in on the job, and save the customer.

Mr. Wallace, of Boston, said that in Boston the organization is very similar to Brooklyn. The complaint department is in the sales department, and all of the operations of the complaint department are subject to the sales department head.

H. J. Gille, of Minneapolis, said that the human element enters into the organization. Central stations have some time realized the difficulty of getting the proper kind of men or the proper kind of development material. He asked Mr. Jones to give his idea of a proper method of promotion for the men, and asked what scheme is employed in Brooklyn.

C. M. Kimball, of Brooklyn, said there are a number of points of contact between the customer and the company; these may be either points of advantage to the customer, or points of advantage to the company, accordingly as they are controlled or handled. The employees of the company may be divided into two divisions, those who come into mental or speaking contact with the customer, and those who come into physical or non-speaking contact.

Mr. Bellplaine, of Syracuse, discussed the power side of the question. He said that with the exceptions of a few very large industrial centers, such as New York, Chicago, St. Louis or Philadelphia, the idea of divorcing the power salesman from power engineer is in general not a good idea. The man who engineers a job is logically the man who should put the man up to the prospect. This sometimes means a careful selection of your power engineer. Better results can be accomplished in the end by paying one man capable of doing both, as much money as you would pay two mediocre men to do the same job.

The discussion was closed by Mr. Jones, who added to Mr. Gille's remarks regarding the human interest part of the paper.

In regard to Mr. Bellplaine's remarks regarding the power salesman and power engineer, Mr. Jones said the power salesman and the power engineer must necessarily in smaller companies, where the business does not warrant the division of those two positions, be made one.

ELECTRIC PUBLICITY.

The next paper to be presented was entitled "A Plan to Interest National Advertisers in Electric Publicity." Owing to the absence of Frank B. Rae, Jr., its author, the paper was read by Philip Dodd.

This paper offers many suggestions for interesting national advertisers in electric advertising. The problems considered by the author were to educated national advertisers and advertising agents to an understanding that electric signs are advertising; to place at their disposal the proper data from which they can estimate the cost and value of electric advertising in the same manner as they estimate the cost and value of magazine space, newspaper space, street car cards or bill-board displays; to keep electric advertising as constantly before their eyes as other methods of advertising. The available methods of educating the advertising fraternity to an understanding of the service comprise writing them letters, bombarding them with printed matter, sending a representative to discuss and explain the proposition and keep the matter constantly agitated by means of articles published in the advertising men's magazines. This is not so large an order as at first appears. There are not above 100 first-class advertising agencies and not more than 250 national advertisers immediately available as prospective users of electric advertising. These agencies and advertisers can be kept in a frenzy by written and printed appeals at a total cost of not above $1,500 annually, which would provide for the mailing of a letter, a post-card or a designed circular every week for a year. The matter of having a representative make personal calls is also comparatively simple, for the prospective customers are, within reason, restricted to the half-dozen big cities of the country, and it would not require a great deal of travelling to reach them. A representative at $1,800 a year, a stenographer at $700 and an expense account of $700 should take care of the personal calls and individual correspondence. Articles for the advertising magazines are even simpler. Then, the advertising clubs should receive attention. Regarding finances the writer reported that he has already approached several manufacturers and been assured of substantial subscriptions for carrying on the work.

E. L. Callahan, of Chicago, opened the discussion by explaining what he has accomplished as a result of his action with national advertisers in this respect. He appealed to the association for action and made a motion to that effect which was unanimously carried.

Mr. Markham, of Chicago, said that when Mr. Rae put the proposition up to the Federal Electric Company as to whether it would co-operate in this proposition with the N. E. L. A. it agreed to it at once. The one point in Mr. Rae's proposition which will mark either the failure or the success of the plan is the co-operation which is gotten from the various central station managers who go into the scheme.

Mr. Seelman said that the plan outlined by Mr. Rae is an excellent one, and if it can be done for the money that he estimates, it is a very cheap one. The plan is such a good one that no time should be lost in working it up, and he suggested that a letter together with copy of this paper should be sent to every central station in cities of a size say over 100,000, or more or less, as it may seem advisable, outlining the plan and asking for subscriptions.

INDUSTRIAL LIGHTING.

"Industrial Lighting with Incandescent Lamps," by H. S. Hall, J. D. Hoit and Paul Bauder, was then read by Mr. Hoit.

Average daylight has been found adequate to meet nearly any operating condition in industrial plants, irrespective of the type or location of the machinery employed. This is shown by saw-tooth roof construction and other attempts to give a maximum of daylight. However, artificial illumination must be provided for dark days and possible overtime or twenty-four-hour operation. The greatest care and most modern methods must be used in laying out the lighting system. Three systems of shop lighting are used: general illumination, which provides high-candlepower units for a uniform lighting of the entire area; specific illumination, which provides low candlepower units for localized lighting of machines or operations; and composite illumination, which provides both general and localized lighting. The committee made an extended series of investigations of the actual lighting conditions found in shops of all kinds and discovered many deplorably inefficient and unsatisfactory installations. In metal-working plants there is some need for specialized lighting of machines where close work is done. The general illumination is usually inadequate. In textile plants artificial illumination is generally required to a large extent. General lighting is almost invariably necessary and it must be of good color value such as supplied by high-candlepower tungsten lamps. Specific illumination is necessary for closely lighting the looms; it is best supplied by forty or sixty-watt tungstens. In clothing and shoe-making shops a brilliant general illumination is provided for the cutting rooms and localized lighting at each machine in the sewing rooms. In paper and pulp mills low general illumination is all that is needed except where coloring of the pulp is done. In printing shops general lighting with 100, 150 or 150-watt tungsten lamps is highly desirable. In factories making paints, dyes, inks, soap, etc., only general illumination of a low intensity is usually required except in a few operations where close work is done, such as in the matching of colors and proper mixing of ingredients, where intense specialized lighting is needed. Flour mills are very difficult to illuminate properly with a scheme of general lighting because of the shadows cast by numerous chutes, and the dust collecting on the lighting units therefore specific illumination is imperative. Wherever food products are handled high-intensity general illumination should be provided to insure cleanliness of the operations. In all shops and factories the substitution of high-efficiency lamps scientifically equipped with appropriate glass or metal shades or reflectors for the old inefficient units still used is bound to improve the illumination markedly at the same time it reduces the lighting peak load. This reduction in peak means a greater generating cost per kilowatt-hour in the case of isolated plants and therefore affords a double incentive for central stations to secure this kind of service under much more favorable conditions than formerly.

H. J. Gille, of Minneapolis, highly commended this paper and said that it should be considered as a reference work. The meeting then adjourned.

THURSDAY AFTERNOON SESSION.

The third commercial session was opened by the presentation of a paper by C. M. Stannard, of Denver, entitled, "Prompt Execution of Orders."

PROMPT EXECUTION OF ORDERS.

Dilatory and slothful methods of doing business invariably cause a company to lose prestige in the community in which it operates. On the other hand, says Mr. Stannard in his paper, promptness and system inspire good will, confidence and respect, and have an undoubted influence on the revenues of the company. The instant that a customer enters the office he should be courteously greeted by some one who, if unable to look after his wants, should direct him to the proper person without the need of going from window to window. This applies particularly to customers with complaints. Applications for light or power service should be handled with dispatch, the clerks receiving them being empowered to put the necessary orders through without

delay so as to insure connection of the service within twenty-four hours. Bills for current should cover uniform periods of thirty days. Duplicate bills should be given immediately and cheerfully whenever requested. The clerk at the complaint window should be an experienced and intelligent trouble man so as to understand the customer's needs even though the latter is unable to express them clearly. Complaint orders should receive the most prompt attention. In many companies a night force of men for special and emergency calls is justified. All employees that come in contact with the public should be called together occasionally for conferences. Orders should not be held up for some trifle in detail. The more promptly an order is executed, the less time there is for a customer to change his mind and cancel it.

Paul Doty opened the discussion of this paper. He commended the views taken by Mr. Stannard and emphasized the importance of promptness. He also spoke of the work of the Board of Trade and Chamber of Commerce in St. Paul.

Mr. Hare, of Philadelphia, said that it is a splendid thing and a profitable sign of the times to have men like Messrs. Lupke, Huey, Jones and Stannard from widely separated parts of this country come here to emphasize the importance of dealing squarely with customers. After these strong arguments in favor of broad relations between the various departments of the company, it shows what the men in charge of these departments can do who deal with the consumer.

W. C. Osborne, of Spokane, said that he has had experience in the last three years in this complaint department, which may be of interest. He thereupon discussed fully his experiences in this connection and outlined how the work is handled in Spokane.

Mr. Burnett said that it is advisable as far as possible to operate under schedule; and by schedule, the same kind of schedule that a railroad runs its trains under. It is very desirable that the company should classify the various classes of work that it has to do in the way of connected and disconnected customers, etc., to the end that the company may fix a certain time in which it will, under ordinary circumstances, be prepared to do certain classes of work. It is very desirable in Baltimore, to fix upon a time of say forty-eight hours within which an installer may connect up a customer who has a meter already on a premises, and who has the service connection established.

Mr. Seelman, of Brooklyn, said that for a long time the Brooklyn company has been interested in eliminating as far as possible all delays between the time a contract is signed and the time connection is made through the company's system, and as far as the organization is concerned and as far as the delays of operation, that company has eliminated every possible delay. There is a big field for delay outside of the company's operations. Mr. Seelman described the delays caused by the various municipal and private authorities and asked that the association take the matter up with the different cities.

Mr. Hutchings said that in the commercial department central stations should be more particular to see when they send an order down that the work is ready to be connected and they will save a lot of time. He said that companies make a great mistake in their commercial department sometimes in putting it up to the operation department and forgetting that the operating department is just as anxious as the commercial department to get that work in.

ELECTRICITY ON THE FARM.

Following this discussion the next paper on the programme, entitled "Electricity on the Farm and the Influence of Irrigation from the Central Station Standpoint," was presented by Herman Russell.

This paper outlines the conditions in Rochester, N. Y., which may be considered typical, wherein about forty per cent of the plant capacity is producing no revenue during the months from April 1 to October 1. The problem that confronts the companies is to find a market for this power during these months. In searching the field for a possible customer the attention of the Rochester company was attracted to the growing use of power on the farms and especially to the increased use of power for irrigation pumping. The paper contains abstracts of several interesting descriptions of installations of this character showing that this field could be made profitable. The paper further outlines a novel new business campaign inaugurated by the Rochester company to interest farmers.

Upon the motion of Mr. Seelman the secretary was authorized to send a copy of this paper to every agricultural station in the country, with the paragraph regarding rates eliminated.

C. N. Stannard, of Denver, said that the point which he admired in the paper was the one made that the Rochester company proposes to try in the East, the experiment of furnishing water for irrigation purposes. Managers say that conditions are so different in one property that they do not apply at all to another property, and ninety-nine out of a hundred station men would make that statement if they were told what work one company was doing in the West in the way of irrigation work, they being located in the East.

Following this discussion the question of forming the commercial association as an independent part of the National Electric Light Association was taken up and after a brief discussion regarding minor points a committee was appointed to formulate plans for the establishment of such an organization. The meeting was then adjourned.

Company Section Session.

The first meeting of the company section was called to order by Chairman Eglin, at 3 o'clock Thursday and the first paper on the programme, entitled "Educating the Central Station Employee" was, in the absence of its author, Prof. S. W. Ashe, read by Walter Robbins.

EDUCATING EMPLOYEES.

Mr. Ashe's paper related some of his experiences and conclusions in conducting the lecture work for the employees of several of the large eastern central-station companies. This work has been carried on for a number of seasons in Brooklyn, New York, Boston and Baltimore with considerable success in raising the educational standard of the employees. The interest of all the men attending the lecture courses has been very keen on the whole. Experimental demonstrations have been found more popular than mathematical or unillustrated talks. A certain amount of entertainment and informality must be interspersed among the strict instructional work. The men should be encouraged to come up after the lecture to ask further questions. In Boston an advanced course was given to electrical men outside the company as well as to its employees. In Baltimore the company's physician gave a very successful course on "First Aid to the Injured." In arranging for a lecture course abundant notice should be given before it is actually begun. A considerable amount of apparatus is required for all the electrical courses.

Following this Henry L. Doherty delivered a very interesting address, an abstract of which follows:

I have taken a great interest in the company section movement and I believe it is the company sections that will have to furnish to the State Sections, the Geographical Section, the National Special Section and the parent body itself the talent for our future development; in other words, I believe that there are more good men still at the bottom than there are good men at the top, and I believe also in the principle with others that we want to give every man a chance. It is impossible for every man connected with an electric light company to attend the conventions of the association, so the plan of organization which has been adopted so far has been to take the convention home to the employe. We desire to have it so arranged that every ambitious employe can use the National Electric Association to better himself, and we want to take the association home to the employe so that he can be bettered by having the help and assistance of every ambitious employe of every central station company in the country. Perhaps we have not yet the right plan and specifications for the work of this association, and if we have not, one place to find it out is in the meeting of the company section.

The past officers of the National Electric Light Association, of which I am one, will all bear witness to the fact that there have been times when it has been extremely difficult to secure the necessary talent to write papers to give us a creditable programme. Now, with the great number of company sections in operation we expect to locate more talent than we can use in our general national programme, and we expect a condition to develop within the association that, regardless of the standing of a man, we can watch his work in these company sections, and we can in that way secure a more creditable presentation of papers for the parent body than could be done in any other way; in other words, it makes it possible to go beyond the men who are known in the business, and go to the men who are practically unknown—the company section makes it possible to reduce the selection of men to a basis of merit rather than the

influence of acquaintanceship. Our so-called membership committee is making a great effort for new members, and they are trying to do something more than simply get new members—every loyal member of the association who understands what is wanted is making an effort to thoroughly organize the industry, and your membership committee might better be called an organization committee. I believe as these company sections are organized, many of the manufacturers will put lecturers on the road whose work will not be purely one of advertising of their particular goods, but will be more or less educational. It is an easy matter to call a meeting of a company section on short notice, and I look forward to the time when any company section can have a skilled lecturer to address its meetings, under the auspices of the various manufacturing concerns. I cannot imagine a quicker way of increasing the knowledge and efficiency of our men than by the encouragement given to manufacturers to send lecturers, perhaps with lanterns and illustrated charts, to address our employes, which will tend to train our men and give them an insight into branches of the business, which could be had in no other way. It is a matter of ten or twelve years ago that the association had a membership of 115, and today it has a membership of 6,000, and not only that, it has a membership that will do anything that is requisite to its success, either among the rank and file or among its officers. A few years ago it was difficult to get a quorum of the executive committee of the association except at the time of the annual convention, but now the executive committee and all other committees meet frequently, and there is always a full attendance.

H. H. Scott opened the discussion. He gave statistics showing the extent of the company-section movement at the present time and referring to its importance said that the section in the larger cities is absolutely necessary. The employes of the company cannot come in contact with the officers unless there is such an organization. He said also that a company section is relatively as valuable to a smaller company.

J. C. Manley, of Chicago, said that about a year and a half ago the Commonwealth Edison Company organized a section, and had 230 or 240 members. That number was brought up to over 500, and they find they can interest some of their employes, but not all of them, and one of the chief reasons why they fail with some of them is that they are a little too technical. In the Commonwealth Company there are approximately 250 wire men and probably 300 central station men. The interior wire men are men of fair ability, but the central station construction man must be educated. The company has a library with a competent librarian. The company pays all the expenses of the section of any entertainment and the expenses of the chairman. The greatest difficulty is to get the members to discuss the papers. Without a discussion of the papers, you cannot get a line on the subjects which you should bring before the members. If you do that, you can accomplish a considerable amount in the discussion line.

C. E. Brenton, of St. Louis, said the Union Section was not organized until March 21, this year. It started with 135 members and now there are 210. Mr. Brenton spoke of the hesitancy on the part of the members to speak at first and how they gradually overcame this. He spoke of the part the company takes in the movement and the benefits and success with which it is meeting. Regarding the subjects discussed, this is decided by a question box to which each member contributes.

George W. Bixler, of Denver, outlined the conditions at the Denver Gas and Electric Company. He said the section has a board of directors, the members of which are divided between the different departments. They constitute the programme committee, and they get together about the 25th of the month and prepare the matter to be inserted in the bulletin which is printed once a month. The bulletin contains all the matter of interest relating to the section. Various subjects are treated in the bulletin each month, such as the elements of electricity, electric pumping or irrigation, the Denver section, administration methods, engineering notes, office department, right way to figure profits, the price of electricity, commercial department notes, and then comes the question box.

Accounting Sessions.

The second accounting session was called to order by Chairman Gilchrist on Wednesday, May 25, at 2:30 p. m.

STOREROOM ACCOUNTING.

A paper by R. F. Pack, of Toronto, on "Storeroom Accounting," which was held over from the morning session, was then presented.

SIGNIFICANCE OF STATISTICS.

A paper entitled "Significance of Statics," by George A. McKana and B. F. McGuire, was presented by the former.

This paper aimed to give some significant statistics, rather than to emphasize the significance of statistics, and presented typical statistical charts and tables prepared from data covering the experience of the Commonwealth Edison Company, of Chicago. The first chart showed some actual statistics on the costs in cents per dollar of income for four important distribution expense accounts, namely, incandescent lamps, street department, substation, meter department. This chart brought out the fact that for the past two years the cost of incandescent lamps per dollar of income was showing a rapid and steady increase. One result of this discovery was the improvement in the method of handling lamps, which effected a saving of $20,000 a year. Other statistical charts and tables, and the results they had in checking and reducing expenses, were shown, indicating clearly the material value of such statistical investigation.

Mr. Fowler, of the Commonwealth Edison Company, Chicago, said his company introduced the Hollerith tabulating system some two or three years ago, and now had fourteen clerks working all their time on it. He thought highly of the system which however was valuable only to the larger companies. However, the small companies should not do less toward analyzing and studying their statistics.

Messrs. Pack, Hale, Edwards, Gilchrist, Fowler and McKana also discussed the paper, the Hollerith tabulating machine coming in for a good deal of mention.

PUBLIC-SERVICE COMMISSION RELATIONS.

H. M. Edwards then presented the report of the Subcommittee on Public-Service Commission Relations (H. M. Edwards, F. L. Dame, G. E. Claflin). The report follows:

This committee was appointed because of the tendency of public-service commissions to prescribe systems of accounts, and the purpose of the appointment of this commission was to take up, on behalf of the Association, with any principal company or any state association those questions which might arise. When this commission began to make up accounting systems, during the recent legislative season, acts providing for the regulation and control of electric-light companies have been passed by the states of New Jersey, Maryland, Mississippi and South Carolina. The state of Virginia has provided for the taxation of franchises, the terms of the act requiring a report by the corporations of their property in the streets and highways of the state, with its value. Of the foregoing states New Jersey and Maryland have authorized their respective commissions to establish uniform systems of accounts. All of the said states require annual reports from the corporations within their jurisdiction so that, in time, comparisons with other corporations wherever located will be possible. Such comparisons to be of any value require that the accounts of reporting companies shall be kept on a uniform basis and therefore the Association has adopted a uniform system of accounts for electric-lighting companies, which system has, thus far, met every demand made upon it. This committee has been appointed for the purpose of bringing to the attention of the various authorities the merits of the system and to urge its adoption in the event that a governmental standard is established. To this end the committee will gladly co-operate with a member company or any of the State associations if requested to do so. It is obvious, however, that the argument in favor of the adoption of the Association's system will be greatly strengthened if it can be shown that the member companies have, of their own volition, adopted it.

CLASSIFICATION OF INCOMES AND SALES.

A paper entitled "Classification of Income and Sales," by Willard W. Dow, was, in the author's absence, presented by Mr. Sawyer.

This paper discusses the several classifications of income now in use to determine their possible shortcomings, treats of the expediency of a supplementary or subsidiary classification of lighting and power, and finally inquires into a form of income account statement best adapted to electric-lighting companies. This last follows to a certain extent the form prescribed by the Interstate Commerce Commission for steam roads, except as to terminology. The author finally recommends a more detailed classification of incomes and sales, and, in any reclassification, that lighting and power

could well replace municipal and commercial as main divisions of revenue from sales of electric energy, and in any further subdivision of sales, that the consumer's relative load-factor should be made on the basis of such segregation; with power, the time of demand should also be considered.

Messrs. Dame, Sawyer and Edwards discussed the paper.

JOB OR WORK ORDER SYSTEM.

R. D. Rubright read a paper entitled "Job or Work Order System."

This paper describes the operation of the Working Order System as used by the Edison Electric Illuminating Company of Brooklyn. This system, it is pointed out, is applicable both to small and to large companies. Recently the Brooklyn company obtained authority from the Public Service Commission of the First District of the State of New York to issue a certain amount of convertible debenture bonds, the proceeds to be used for property chargeable to capital as an extension, addition or betterment of the physical property of the company, conditional upon the filing with the commission of a statement showing the monthly cost on each general class of work. By means of the Working Order System in the Brooklyn company compliance with the commission's order is effected within twenty-four hours after the closing of the books for the month. In summing up the features of the Working Order System in this paper, the author lays particular emphasis on the necessity of keeping the auditor advised on any job exceeding its estimate, so that whenever this happens the superintendent can be notified at once. It cannot be too clearly laid down that the Working Order System demands an exacting adherence to the details of the cost of jobs quite as close and precise as that a builder gives to the plans and specifications of the architect.

The paper was discussed by Messrs. Brundage, Brenton, Coleman and Pack, whereupon an adjournment was taken until May 26, 10 a. m.

THIRD ACCOUNTING SESSION.

The third accounting session was called to order on Thursday, May 26, at 10:25 a. m., by Chairman Gilchrist, and a paper on "Meter Records" was presented by Douglass Burnett. A spirited discussion followed:

A paper by R. F. Bonsall, entitled "Keeping of Customers' Records," was presented by D. Burnett. This paper describes the various steps through which a customer's record must pass, beginning with the inquiry for service and leading up in turn to the time when he is "cut in" service. A discussion followed.

John C. Van Duyne read a paper on "The Workings of a Collection Bureau," describing the system and forms used by the New York Edison Company. This paper was discussed by Messrs. Pack, Spoehrer, Slater, Wheeler, Edwards and Thomas, and various questions were answered by the author.

A. L. Holme, of the New York Edison Company, read a paper on "Accounting Symbols," which was not discussed.

The session was closed by Vice-Chairman Bailey, who announced that the chief work of the Accounting Committee for the coming year would be devoted mainly to the adoption of the Association's classification of accounts by all member companies and to frame up some scheme for the recording and distribution of statistics.

An adjournment *sine die* was then declared.

Closing General and Techincal Session.

The concluding general and technical session was called to order by President Frueauff at 10:30 o'clock Friday morning. The report of the Committee on the Preservative Treatment of Poles and Crossarms was presented by W. K. Vanderpoel.

PRESERVATIVE TREATMENT.

Mr. Vanderpoel abstracted the report and at his conclusion said that it would be necessary for future committees to work up certain details properly in regard to cost and also in regard to details of plant construction.

Farley Osgood, in discussing this report, said that the report was one of great importance, and if the committee could indicate a preservative method by which cross-arms and pins could be protected against decaying, a very great saving would be made. He thought that it would be possible to save $1,000,000 a a year by properly treating wood used in construction work.

President Frueauff called upon Professor Herman von Schrenk, supervisor of timber preservation of the Chicago & Eastern Illinois, Frisco and Rock Island railroads. He is also a member of the Tie Committee and Wood Preserving Committee of the American Railway Engineering and Maintenance of Way Association. He called attention to the substitutes which are used in place of creosoted oil, and warned the association against the use of these substitutes. He was of the opinion that mere surface application of preservative compounds was of little value. Preservative processes were of value only when they were applied in the proper way, and this can be discovered only after painstaking study and a close analysis of the conditions. He made a plea for co-operation on the part of the association with other technical societies and invited the convention to get in touch with the American Society for Testing Materials and the Maintenance of Way Association, so that a standard set of specifications might be worked out.

The committee on the amendments to the constitution presented its report.

ELECTION OF OFFICERS.

The report of the nominating committee was then presented as follows:

President, W. W. Freeman, Brooklyn, N. Y.

First vice-president, John F. Gilchrist, Chicago, Ill.

Second vice-president, Frank M. Tait, Dayton, Ohio.

Executive Committee, Alex Dow, Detroit, Mich.; H. A. Wagner, Baltimore, Md.; W. C. L. Eglin, Philadelphia, Pa.

The nominating committee recommended that the executive committee appoint Gen. George H. Harries as treasurer and T. Commerford Martin as secretary.

It was regularly moved and seconded that the secretary be instructed to pass one ballot covering the nominations. This was duly ordered and the president appointed Farley Osgood and James Montague to escort Mr. Freeman to the platform.

Mr. Frueauff presented the badge of office to Mr. Freeman and predicted that the coming year would prove the most brilliant in the history of the association.

Mr. Freeman replied briefly, thanking the membership for the honor it had conferred upon him, and in accepting this honor said he did so with the full appreciation that the president could hope to receive the hearty co-operation of the entire membership, without which the work of the year would be fruitless.

President Frueauff resumed the chair and upon motion of Mr. Montague a resolution was passed to the effect that a recommendation be made to the incoming president asking for the appointment a committee which shall include S. E. Doane, to carry out the important suggestions made by Mr. Doane in his paper on "High Efficiency Lamps." This resolution was seconded and carried.

INSURANCE REPORT.

The report of the insurance expert, W. H. Blood, Jr., of Boston, was presented. The report discussed the organization of the committee and the work that has been accomplished. The new code was distributed about six months ago and it has been felt that a great deal of good has resulted. At the last meeting of the underwriters in New York in March, 1909, it was voted to have no further meetings until the year 1911. The next meeting will therefore be held in March, 1911. The report also describes the work of the insurance expert with regard to the case of the Consolidated Light Company of Montpelier, Vt., and the lighting company at Hobart, Okla., where both companies were saved a great deal of physical embarrassment and unnecessary expense. Gasolene competition continues as an annoyance in certain localities. In Colorado, gasoline lighting plants unapproved by the underwriters are constantly being installed. A move is on foot to take away from the stock companies the insurance business of the electric lighting companies unless the underwriters change their method of procedure with regard to these gasolene lighting plants. The report indicated that the electric light and power companies of the country are as a whole paying much larger premiums for their insurance than they should.

The report of the committee was

adopted and then the following resolution was moved and accepted:

"Whereas, in the thirty-third annual convention of the National Electric Light Association, convened in St. Louis, May 24, 1910, certain figures were presented by our insurance expert which tend to show that the fire insurance premium rates paid by the electric lighting companies of the country at large are fully twice as high as the loss ratio warrants.

"Be it resolved, that this convention makes notes of this fact and directs that the matter be called to the attention of the fire insurance companies throughout the country, and that a demand be made for an investigation by them of existing rates, and that a reduction be made commensurate with the premiums received and the risks involved.

"Be it further resolved, that copies of these resolutions be furnished every member company of this Association and that through them the insurance companies writing the various risks be informed of the action of this meeting, and that a positive demand be made for a material reduction in rates."

Mr. Vanderpoel replied briefly to some of the questions asked with regard to the report on the preservative treatment of poles and cross-arms, and the president called for the paper entitled "Decentralized Plants," by R. D. DeWolf, Rochester, N. Y.

There being no discussion of this paper, Dr. Edward P. Hyde, director of the physical laboratory of the National Electric Lamp Association, made an announcement concerning technical courses on illuminating engineering, to be given at Johns Hopkins University, Baltimore, Md. Dr. Hyde called attention to the great growth of the Illuminating Engineering Society in the United States, and said that a similar organization had been formed in England and another organization was contemplated in Germany. He thought that no better work could be done than to bring to a focus some of the ideas that had been put forth during the last four years, and make a definite effort for the co-ordinating of the science and art of illuminating engineering.

The paper by W. L. Waters of Pittsburg, entitled "Direct Turbo Generators" was then presented.

There was no discussion on this paper and the report of the committee on the president's address was received as follows:

"The committee appointed to consider the president's address feel that they would be lacking in their duty to the association and neglectful of praise which is well merited by successful effort, if they failed to put on record their high appreciation of the services rendered by President Frueauff and his administration during the past year.

"President Frueauff's term of service marks the highest record of success of the association.

"The committee takes pleasure in recommending to the executive committee and the incoming president that the various suggestions made in President Frueauff's address should be carried out."

Secretary Martin made a verbal report for the committee on memorials and referred to the deaths of George F. Porter, D. O. Mills, Jotham Potter and H. C. Buddy.

Brief remarks were made by W. A. Sparks of Louisville, and Mr. Irvine, president of the Missouri Electric Light Association.

FINAL RESOLUTIONS.

The report of the committee on final resolutions was presented by Secretary Martin. These resolutions included the hearty thanks of the association to the associated electrical papers, *Central Stations, Electrical Record*, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, *Electrical World, Illuminating Engineer, Popular Electricity, Selling Electricity*, and *Southern Electrician*, for their generosity in publishing at their expense on behalf of the Association the *Convention Daily*. The association congratulated these journals upon the success that has attended their efforts, and conveyed its thanks to the editorial staff, W. E. Keily, D. H. Braymer, H. S. Cushing, Jr., H. Ehrlich, Frank B. Rae, Jr., H. Riddell, G. A. Wardlaw, H. W. Young, and O. H. Caldwell. Resolutions of regret regarding the death of George F. Porter were presented. The thanks of the Association were conveyed by resolution to the United Railways Company of St. Louis, Captain Robert McCulloch, president of the company; the Union Electric Light and Power Company and President Miller; the local entertainment committee; the Class D members and exhibition committee; Mr. Samuel Insull in appreciation of his anniversary address; the standing committees; Mr. Hodskinson, master of transportation, and the executive secretary, T. C. Martin, and the loyal and devoted members of his staff.

The last resolution was tendered to the elective officers of the association during the year, President Frueauff, Vice-Presidents Freeman and Gilchrist, and F. M. Tait.

Following the adoption of these resolutions the executive session and convention adjourned.

Convention Notes.

In point of attendance, in display of enthusiasm and in general satisfaction, the thirty-third convention of the National Electric Light Association will probably go down in history as the most successful in the life of the Association. The setting of the convention and the accompanying exhibition of the Class D members, the manufacturers of electrical apparatus and kindred appliances and supplies, was particularly fortunate and the hospitality displayed by the local entertainment committee and the interest manifested by the attending delegates has left a very favorable impression.

The arrangements for the various sessions were particularly good, ample meeting rooms having been provided for the various sections, although it is a fact that the acoustic properties of the main hall where the commercial sessions and the anniversary session were held were of a decidedly negative order. It was too bad that the otherwise good facilities for the anniversary reception should have been marred to a slight degree by the necessity of imposing a very great strain upon the auditors in making themselves heard even a short distance beyond the platform. This is no reflection upon the arrangement committee, as every effort was made to render the acoustic conditions perfect and a great deal of ingenuity and effort were displayed to render the setting all that could be desired.

There were many parties, both formal and informal, probably the first being given by President Frueauff as a preliminary to the opening of the convention on Sunday evening at the Jefferson. This party comprised the officers and others on the staff who had arrived as an advance-guard. The party included Mr. and Mrs. Frueauff, Mrs. Frueauff, the president's mother, Mr. and Mrs. W. W. Freeman, Mr. and Mrs. F. M. Tait, Mr. and Mrs. J. M. Connelly, T. C. Martin, Miss E. M. Meyers, Miss Burkhalter, Miss Burgoyne, F. H. Gale and C. Frueauff.

A. A. Brown, of New York, gave a stag dinner to a dozen friends on Tuesday evening at the Planters Hotel.

L. P. Sawyer, secretary and treasurer of the Buckeye Electric Company, Cleveland, gave a dinner at Tony Faust's to some fifteen of his friends. Among the guests were Messrs. Orr, Hegarty, Doane, Harvey Drake, J. Robert Crouse, J. M. Wakeman, Jos. H. Cooke and Mr. Warner.

E. H. Haughton, manager of the Bryan-Marsh Company, Chicago, Ill., and Mrs. Haughton gave a delightful dinner at the Delmar Gardens to Mr. and Mrs. Frueauff and a party of friends on Thursday evening.

J. M. Wakeman gave an informal luncheon to several of the executive officers and past presidents in honor of Hugh M. Wilson.

On Thursday evening the Allis-Chalmers Company entertained about twenty-five of its friends at an informal dinner at the Mercantile Club. The entertainment following the dinner was furnished by T. B. Arnold, of the Union Spring and Manufacturing Company, of Pittsburg. For more than an hour Mr. Arnold manipulated three packs of playing cards in a manner that caused one surprise after another. The tricks he performed were not of the ordinary stage variety and so far outclassed that sort of thing that many of those present were ready to believe that they were under some hypnotic spell. The cards were new and had been purchased during the afternoon by a selected representative and were taken from their original sealed cases in the presence of the guests. It is impossible to describe the dexterity with which the cards were manipulated, and the entertainment was one of the most novel and edifying that has been witnessed. Those present were: A. H. Whiteside, J. R. Jeffrey, M. A. McCauley, A. P. Doddridge, R. E. Lee, H. W. Chase, T. D. Buckwell, A. E. Greene, I. L. Meloon, W. G. Meloon, T. B. Arnold, E. T. Pardee, H. G. Sands, F. L. Bunton, S. Fred Smith, H. W. Cheney, L. B. Ritchie, J. B. Nicholson, L. P. Nichols, Guy Strafer, F. C. Colwell, Frank G. Bolles and A. A. Gray. On Friday at noon Mr. Bolles induced Mr. Arnold to again display his dexterity before about twenty friends, and

those present at this occasion also marveled at the remarkable demonstration.

The opening of the exhibits was attended by a general reception which was held in the ball room, and on the receiving line were: Mr. and Mrs. Frueauff, Mrs. Frueauff, mother of the president, Mr. and Mrs. W. W. Freeman, Mr. and Mrs. John F. Gilchrist, Mr. and Mrs. H. H. Humphrey, Mr. and Mrs. W. A. Layman, Mr. and Mrs. Alten S. Miller, Mr. and Mrs. Robert McCulloch, Mr. and Mrs. F. M. Tait, Mr. and Mrs. Arthur Garrison, Mr. and Mrs. Pantaleoni, Mr. and Mrs. Wm. Clegg, Jr., Mr. and Mrs. Gallaher, T. C. Martin, W. N. Matthews and F. E. Newbury. Following the reception music for dancing was furnished by Poepping's orchestra.

A very interesting convention of managers and prominent officers of the Stone & Webster Management Association and the Stone & Webster Engineering Corporation was held in the Jefferson Hotel on Monday afternoon. The meeting was presided over by Wm. H. Blood, Jr. There were a number of short papers and an excellent discussion.

The special trains and transportation arrangements in general were well handled by Mr. Hodskinson, and the Chicago special under the arrangement of John J. Schayer, made a record run from Chicago to St. Louis in six hours and eighteen minutes, and another record run from St. Louis to Chicago in six hours and thirty minutes. The table d'hote dinner served on the Chicago special was a feature which elicited a great deal of very favorable comment.

The Commonwealth Edison Company sent a delegation of 100 men to the convention on Wednesday. The party left Chicago on Tuesday night on a special train, and left late Wednesday night for the return to Chicago. Of the 100 delegates from the Chicago branch of the National Electric Light Association, twenty were nominated by President Samuel Insull of the Commonwealth Edison Company, and eighty were elected by ballot by the members of the section. This enterprise and generosity were greatly appreciated not only by the association, but by the employes of the company.

The entertainment features were particularly complete. In addition to the opening reception there were automobile rides for the ladies and guests through the residence portion and parks of St. Louis, terminating at Shaw's Garden, where the botanical collection was on exhibition. There was also a theater party for the ladies at the Suburban Gardens, where Amelia Bingham presented "Lady Huntworth's Experiment." There was a luncheon and entertainment at the Glen Echo Country Club, and on Thursday afternoon all hands were invited and a large number made the trip to the Anheuser-Busch brewery. On Thursday evening the entire vaudeville theater was secured for the entertainment at Delmar Garden. This was not only a novel but highly interesting entertainment. In addition to the professional talent there were a number of head-liners from among the members of the association. E. H. Haughton, manager of the Bryan-Marsh Company, gave a most remarkable impersonation of the great band leader, Creatore. The make-up and action were very fine, and "Ernie" received an ovation from the big crowd. Harry Curtis Rice, vice-president and general manager of the G.-I. Lamp Company, Cleveland, Ohio, delivered a most laughable monologue and survived the "guying" of the boys who were out to shout him down by his quick wit and sparkling repartee. Sam. Furst, of the Bryan-Marsh Company, made a big hit, and Jack Cross was a very amusing Dutch comedian.

The National Electric Light Association's twenty-fifth anniversary number of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, distributed at the convention, attracted a great deal of favorable attention, and the historical data and resume of the early proceedings and the development of the association during the past twenty-five years elicited great interest. The tabulation giving the names of the presidents and places and dates of meeting of the thirty-three conventions which have been held attracted so much attention that it is being reprinted in this issue, with one or two corrections, which makes it exact and up to date.

Of the twenty-three presidents named in this table all but two, S. T. Carnes and J. B. Cahoon, are living, and of these the following were present at this convention: James I. Ayer, Samuel Insull, Henry L. Doherty, L. A. Ferguson, C. L. Edgar, Wm. H. Blood, Jr., Arthur Williams, W. C. L. Eglin and F. W. Frueauff. Dudley Farrand was greatly missed, and his friends were sorry indeed to learn that he had met with a slight disablement which made it impossible for him to get to St. Louis. H. M. Byllesby was among those missed, it being impossible for him to be present. There was another who has been one of the most conspicuous figures at many conventions, and resolutions were passed by each of the sections expressing sympathy to Miss Harriet Billings, assistant secretary, who is now on a vacation at her home in Vermont. Expressions of regret at the death of George F. Porter, the veteran master of transportation, indicated the esteem in which he had been held.

CONVENTIONS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION—1885-1910.

Date.	Presidents.	Places.
1885—February 25-26	J. Frank Morrison.	Chicago, Ill.
1885—August 18-19-20.	J. Frank Morrison.	New York, N. Y.
1886—February 10-11-12.	J. Frank Morrison.	Baltimore, Md.
1886—August 31. September 1-2.	J. Frank Morrison.	Detroit, Mich.
1887—February 15-16-17.	J. Frank Morrison.	Philadelphia, Pa.
1887—August 9-10-11.	J. Frank Morrison.	Boston, Mass.
1888—February 21-22-23.	J. Frank Morrison.	Pittsburg, Pa.
1888—August 29-30-31.	S. A. Duncan.	New York, N. Y.
1889—February 19-20-21.	S. A. Duncan.	Chicago, Ill.
1889—August 6-7-8.	E. R. Weeks.	Niagara Falls, N. Y.
1890—February 11-12-13-14.	Marsden J. Perry.	Kansas City, Mo.
1890—August 19-20-21.	Marsden J. Perry.	Cape May, N. J.
1891—February 17-18-19.	Marsden J. Perry.	Providence, R. I.
1891—September 7-8-9-10.	Chas. R. Huntley.	Montreal, Can.
1892—February 23-24-25.	Chas. R. Huntley.	Buffalo, N. Y.
1893—February 28. March 1-2.	James I. Ayer.	St. Louis, Mo
1894—February 27-28. March 1-2.	E. A. Armstrong.	Washington, D. C.
1895—February 19-20-21.	M. J. Francisco.	Cleveland, Ohio.
1896—May 5-6-7.	C. H. Wilmerding.	New York, N. Y.
1897—June 8-9-10.	Frederic Nicholls.	Niagara Falls, N. Y.
1898—June 7-8-9.	Samuel Insull.	Chicago, Ill.
1899—May 23-24-25.	A. M. Young.	New York, N. Y.
1900—May 22-23-24.	S. T. Carnes.	Chicago, Ill.
1901—May 21-22-23.	James Blake Cahoon.	Niagara Falls, N. Y.
1902—May 20-21-22.	Henry L. Doherty.	Cincinnati, Ohio.
1903—May 26-27-28.	Louis A. Ferguson	Chicago, Ill.
1904—May 24-25-26.	Chas. L. Edgar.	Boston, Mass.
1905—June 6-7-8-9-10-11.	Ernest H. Davis.	Denver, Colo.
1906—June 5-6-7-8.	Wm. H. Blood, Jr.	Atlantic City, N. J.
1907—June 4-5-6-7.	Arthur Williams.	Washington, D. C.
1908—May 19-20-21-22.	Dudley Farrand.	Chicago, Ill.
1909—June 1 to 5.	W. C. L. Eglin.	Atlantic City, N. J.
1910—May 23 to 27.	F. W. Frueauff.	St. Louis, Mo.

The exhibition committee headed by Frank H. Gale, chairman, and including James I. Ayer, S. E. Doane, Rodman Gilder, W. S. Heger, E. T. Pardee, H. G. McConnaughy, J. C. McQuiston, H. W. Young, Charles E. Brown, F. X. Cleary and Walter Neumuller, secretary, deserved the highest degree of credit for their untiring effort and the great success of their plans both in the placing and physical arrangement of the exhibits. The exhibition hall was tastefully decorated in light colored bunting, and the ornamental tungsten clusters made the scene one of great beauty. There was ample aisle room and the arrangements of exhibits were such that any apparatus or article sought could be easily discovered and its advantages determined upon.

On Thursday afternoon there was a meeting of the Class D members when the exhibition committee made its report. The nominating committee, consisting of J. I. Ayer, Frank Bolles and A. A. Gray, presented the following ticket: J. C. McQuiston, of Pittsburg, to succeed himself for three years; F. X. Cleary, of New York, to succeed himself for three yers; E. T. Pardee, of Milwaukee, to succeed Rodman Gilder for three years; Charles Blizard, of Philadelphia, to succeed Mr. Pardee, who was filling the unexpired term of W. S. Heger; W. A. Layman, of St. Louis, to succeed C. E. Brown, who was filling the unexpired term of H. W. Young. The secretary was instructed to cast a ballot for this ticket. A resolution was presented by Mr. Ayer conveying to Miss Billings the deep regret of her many friends in the Class D membership that she was prevented from attending the convention.

The secretary and treasurer, Walter Neumuller, presented a report which showed that the total value of space sold amounted to $9,155, leaving a balance after expenses were paid of $1,830. Upon the motion of J. M. Wakeman the thanks of the membership was voted to Mr. Gale for his very efficient service as chairman of the committee. At the meeting of the exhibition committee on Friday morning, J. C. McQuiston was elected chairman of the committee.

N. E. L. A. EXHIBITS.

The exhibit of the Class D members was comprehensive and of a highly interesting character. Among those making prominent displays were the following:

The Frank Adam Electric Company, St. Louis, Mo., showed a number of its panel boards and switches of various types and a completely equipped switchboard. Representing the company were F. B. Adam and A. C. Brandt.

The Allis-Chalmers Company, Milwaukee, Wis., had a conspicuous booth to which considerable attention was directed. Among the exhibits were two direct-current shunt motors, two induction motors, several transformers of various sizes with five per cent and ten per cent taps for voltage regulation, a sectional model of the company's steam turbine showing the blading, and a new series of both automatic and non-automatic oil switches. These switches were shown for the first time. They are arranged so that the switch body can be very easily removed for inspection. Among the representatives of the company were: A. H.

Whiteside, E. T. Pardee, J. R. Jeffrey, J. W. Gardner, F. C. Coldwell, F. L. Bunton, G. Strafer, J. C. Nichols, H. W. Cheney, J. B. Nicholson and F. G. Bolles, the latter being in charge of the exhibit.

The American District Steam Company, Lockport, N. Y., converted its booth into a reception room for the use of its many friends. These were liberally supplied with the publications of the company giving full explanations of its system of exhaust steam heating as a central-station auxiliary service and also complete reports on the performance of many plants where this system is installed. The company was represented by C. R. Bishop, W. J. Kline, W. H. Wells, E. L. Barnes and H. C. Kimbrough.

The American Electrical Heater Company, Detroit, Mich., made an attractive display of its numerous heating appliances, including the "Steel-Clad" and "Superior" electric flatirons for domestic and laundry service, coffee percolators, tea kettles, toasters, water heaters, heating pads and other "American" heating devices. Describing the features of these appliances were: Jas. Strasburg, B. H. Scranton, John Scudder, Frank Kuhn, Robert Kuhn and Guido Kuhn.

The American "Z" Electric Lamp Company, New York, showed a series of tungsten lamps burning in every conceivable position. M. D. Kitt explained the features of these lamps.

The Anderson Carriage Company, Detroit, Mich., displayed a four-passenger model D coupe containing a forty-cell, 225-ampere-hour Edison storage battery. G. D. Fairgrieve, J. R. Brown and C. F. Brown represented the company.

The Automobile Maintenance and Manufacturing Company, Chicago, had a 3,000-pound electric express wagon for demonstration on the street in front of the Coliseum. In the booth was a 1,500-pound delivery wagon. These vehicles were equipped with the Walker balance-gear drive, in which the single motor and the gearing are completely encased and run in oil, the reduction gearing being in the rear wheels, which are hollow. G. R. Walker and G. A. Freeman showed the merits of these.

The Baker Motor Vehicle Company, Cleveland, showed a victoria and a four-passenger extension coupe. These cars are provided with interchangeable bodies so as to make them readily convertible for summer or winter use. Both models exhibited were elegantly finished, the coupe being provided with all the luxurious conveniences that could be desired. O. B. Henderson, H. W. Dickerman and K. H. Kellam explained the value of such electric vehicles as central-station loads.

The Benjamin Electric Manufacturing Company, Chicago, displayed a series of its well-known lighting specialties and wireless clusters, including the new "Parabolite" reflector for street lamps. In attendance for the company were R. B. Benjamin, W. D. Steele, H. E. Watson, B. G. Kadjbanoff and G. C. Knott.

The H. B. Camp Company, New York, showed a number of samples of "Camp-Duct" and photographs of typical conduit installations. The company was represented by R. P. Keasbey and C. C. Baird.

The Central Station Development Company, Cleveland, had two booths, one as a reception room for its visitors, and the other containing a complete array of its literature and filing systems by which the new business departments of central stations are enabled to make systematic and thorough campaigns for the extensions of electric service in any community. Comprised in this collection were circulars, follow-up letters, card indexes, order blanks, meter records, complaint cards, etc., for every phase of an electrical sales department's activity. W. H. Wissing, E. J. Kulas and R. Cole represented the company.

The Century Electric Company, St. Louis, exhibited a complete assortment of single-phase motors from one-quarter to forty horsepower in size. These are all self-starting motors and are made in both horizontal and vertical types. A number of special motors and ceiling fans were also shown. E. S. Pillsbury, R. J. Russell, H. S. Kellogg and J. C. Woodress were present on behalf of the company.

The Columbia Meter Company, Indianapolis, showed a number of its meters, including a rotating test wattmeter, as well as the house type, switchboard type and alternating-current meters. The direct-current meters are equipped with silver-tipped wire brushes and a special device to render them free from dust troubles. The armature is extremely light and has but three coils. F. L. Pauli, S. E. Test and C. A. Hornberger explained the features of these meters.

The Columbus Buggy Company, Columbus, Ohio, showed a four-passenger coupe and a set of its working parts.

The Crocker-Wheeler Company, Ampere, N. J., displayed several induction motors and transformers for lighting circuits. There were also shown a large number of photographs of the company's electrical machinery, including both direct current and alternating-current generators and motors up to 5,000-kilowatt rating. Representing the company were Rodman Gilder, D. V. Sideman, C. E. Delafield, Julian Roe, H. J. Sage and H. E. Kirber.

The D & W Fuse Company, Providence, R. I., showed a complete line of boxes for service switches, main and feeder taps, transformer cut-outs and other subway fixtures. An assortment of fuses, wire and coils was also displayed. The company representatives were H. F. MacGuyer, R. C. Patton, W. S. Sisson and L. W. Downs.

The Dearborn Drug and Chemical Works, Chicago, made no exhibit of its chemicals for the treatment of boiler feed waters, but George C. Carr, Frank Eardley and H. G. McConnaughy, on behalf of the company, explained to visitors to the booth the methods of careful preliminary analysis and various treatments as determined by the results of the analysis.

The Diamond Rubber Company, Akron, Ohio, displayed representative coils of National Code wire, small samples being ready for distribution to those who wished to make a closer examination. There was also shown a complete sample case of Diamond rubber-covered wires and cables, single and multiple conductor, and lead encased. O. J. Woodard, P. Huben and W. I. Morrow were in attendance.

Dossert & Company, New York, exhibited several new devices in connection with cable splicing. The use to which Dossert lugs have been put for pulling and permanently suspending cables was shown, as well as the application of the lug for taking off a lead to a panel board. One of the features of the exhibit was a board equipped with soldered splices and joints made with Dossert connectors with the relative conductivity of cable and different joints. Various methods of overcoming difficulties by means of the company's connectors were explained by H. B. Logan and H. S. Shope.

The Duncan Electric Manufacturing Company, Lafayette, Ind., showed the most complete assortment of Duncan electrical products ever exhibited. It consisted of a complete array of direct current and alternating-current-watthour meters for house service as well as switchboard use. A standard rotating test meter and a set of Duncan transformers were also shown. Adrian Tobias, M. E. Mozingo and J. A. Clark explained the features of Duncan apparatus.

The Edison Storage Battery Company, Orange, N. J., displayed four types of the new Edison storage cell, which attracted much attention. These cells are intended for electric vehicle use, ignition purposes, car lighting, launch propulsion and similar service where a light-weight, high-capacity cell is needed. W. G. Bee, A. J. Doty and C. B. Frayer were kept busy answering questions regarding these Edison batteries.

The Electric Motor and Equipment Company, Newark, N. J., showed a very attractive electric portable lamp with an inner prismatic glass hemisphere surmounted by an art glass shade. The arrangement gives an excellent light distribution. S. H. M. Agens demonstrated the good points of the lamp.

The Electric Service Supplies Company, Philadelphia, displayed a good line of Garton-Daniels lightning arresters and a number of specialties of its own, such as the Keystone porch-lighting fixtures. The company representatives were J. W. Porter, G. W. Fox and J. R. McFarlin.

The Electric Storage Battery Company, Philadelphia, had a compact exhibit of sample plates of its many types of cells. The company was well represented, among those present being Chas. Blizard, G. H. Atkin, H. M. Marshall and H. B. Gay.

The Excess Indicator Company, New York, exhibited a number of its indicators for showing when the load contracted for has been exceeded by flat-rate consumers. The installation of tungsten lamps for small residences where the use of a meter is scarcely justified has created a demand for such indicators. A. T. Holbrook demonstrated the value of these excess devices.

The Federal Electric Company, Chicago, displayed its sectional letter signs as well as a line of lighting specialties. Among these was a new window sign which is at the same time an excellent reflector for lighting the window. A vacuum cleaner and ozonizer were also shown. The company was represented by F. H. Willing, C. H. Froelich, R. Spalding, J. M. Gilchrist.

The Fibre Conduit Company, Orangeburg, N. J., had a number of samples of conduit on view as well as a number of books and circulars describing its desirable qualities. C. S. Sparrow was in attendance at the booth.

The Fort Wayne Electric Works, Fort Wayne, Ind., had on exhibition a complete line of supplies, meters, transformers, compensarcs, etc. A feature of the exhibit was a testing board for meters. This was equipped with standard wattmeters, shunt and series instrument transformers, reactance load and non-inductive load arranged for testing four meters at once. All adjustments were arranged in the simplest manner. The transformers on exhibition were of the shell type and in order to admit of minute inspection cross-sectional views, made up of standard coils and laminations, were at hand. Alternating current and direct-current compensarcs designed to take the place of resistance in reducing the voltage for arc lamps such as are used for moving-picture machines formed part of the display. A standard alternating-current regulator and panel were set up and used in connection with series alternating-current arc lamps and multiple arc lamps. Among the representatives of the company were C. A. Thomas, M. Knight and A. A. Serva.

The G. & W. Electric Specialty Company, Chicago, showed a complete line of potheads. The detachable pothead consisted of a combined pothead and switch, the construction being such that the device will be operative in manholes filled with water. This was demonstrated by passing an alternating current at 2,000 volts through one of these devices immersed in water. Another form shown consisted of three porcelain members and a heavy copper connector. Two sizes were shown, one for 500,000 and the other for 1,000,000-circular mil

cable. Other features of this exhibit were combination potheads and series switches, combination pothead and subway junction boxes, safety line disconnectors, and ground-pipe caps. Albert Wakefield represented the company.

The General Compressed Air and Vacuum Machinery Company, St. Louis, showed two Thurman portable electric vacuum cleaners and one stationary machine. The strong points of these machines was clearly demonstrated by J. S. Thurman, F. Smith and C. N. Terry.

The General Electric Company, as usual, made an extensive exhibit of electric heating devices, lamps, fans and other motors, meters, etc. In the heating line were shown a new electric range with an excellent oven and broiler designed on the lines of the best gas ranges, quick-acting disk stoves using the new Calorite wire, two-bulb luminous radiators for use on lighting circuits, artistic chafing dishes, tea kettles and percolators, restaurant-size toasters, flat-irons for household, laundry and tailors' use, removable unit soldering irons, oil-tempering baths, etc. In the lamp exhibit were a complete line of tungsten lamps from miniature and low-voltage lamps to 500-watt units, many of them equipped with appropriate shades, reflectors and diffusers; there were also direct-current intensified and flaming arc lamps. A variety of the newest models of fan motors, sewing-machine motors, single-phase variable-speed motors, buffing and grinding motor sets and other small motors were displayed. In the line of meters were shown an alternating-current prepayment watthour-meter, a direct-current galvanometer type voltmeter and an instrument potential transformer. Two feeder regulators with their voltmeters, relays and other auxiliary apparatus were also shown. Among the many General Electric men present were: J. R. Lovejoy, C. D. Haskins, J. R. McKee, D. R. Bullen, E. E. Gilbert, Dr. C. P. Steinmetz, D. B. Rushmore, N. R. Birge, Frank H. Gale, W. D'A. Ryan, C. E. Stone, M. O. Troy, F. G. Vaughan, W. M. Stearns, C. B. Burleigh, J. W. Johnson, F. N. Boyer, W. H. Colman, J. Scribner, H. C. Houck, Gen. Irving Hale, G. A. Wooley, G. N. Robinson, A. D. Page, F. W. Willcox, A. D. Babson, F. C. Bates, M. Fathersfield and G. D. Rosenthal.

The General Vehicle Company, Long Island City, N. Y., showed a two-ton chassis for an electric vehicle and a large number of views of vehicles that have been supplied for central-station use in arc-lamp trimming, lamp-renewal and supply delivery, etc. J. H. Vail, P. C. Chrysler and C. L. Morgan were in attendance at the exhibit.

G. M. Gest, subway engineer and contractor, was represented by W. T. Jackson.

Gudeman & Company, New York, showed an assortment of beautiful electrical decorations and novelties, chiefly floral. Among these were exquisite flower and fruit baskets, bushes, wreaths, festoons, etc. Christmas tree outfits and miniature lamps for all these electrical novelties were also shown. L. Gudeman was in charge of the booth.

The Hart Manufacturing Company, Hartford, Conn., showed its new line of meter connection blocks, as well as the well-known "Diamond H" switches and receptacles. Among these were large capacity meter blocks, service switches, combination service switches and meter blocks, and a thermostatically controlled switch. In attendance were G. W. Hart, H. A. Hart, G. E. Palmer and A. L. Moses.

The Heine Safety Boiler Company, St. Louis, showed a model of its water-tube boiler and gave information on their performance. J. C. Murphy took care of this company's interests and conducted a large number of visitors through its boiler shops.

Hubbard & Company, Pittsburg, exhibited their extensive line of pole-line hardware, fittings and tools. The use of Peirce expansion bolts, hammer drills and other specialties was demonstrated for the benefit of central-station men. C. L. Peirce, Jr., and B. S. Handwork represented the company.

The Hughes Electric Heating Company, Chicago, showed a number of its new electric cook stoves with one, two or three burners, and with or without baking and warming ovens. G. A. Hughes, F. B. Thompson and T. M. Caven were on hand to explain the merits of these stoves.

The Hurley Machine Company, Chicago, displayed its well-known Thor electric combined washing and wringing machines operated from the ordinary lighting circuit. N. C. Hurley, W. T. Haynie, W. J. Conlon and W. A. Murphy were the company's representatives.

W. J. Jeandron, New York, exhibited a complete line of the "Le Carbone" carbon brushes, for which he is the exclusive American agent. Assisting Mr. Jeandron was H. Steins.

The H. W. Johns-Manville Company, New York, featured the latest types of Noark service and subway boxes, Linolite electroliers, and the new J-M fiber conduit and fittings. This J-M conduit is unusual from the fact that it is of molded construction which gives it exceptional strength. It is entirely without grain or lamination and there is no reduction of cross section at the joints as these are bell-shape. The glass-smooth internal bore prevents abrasion of the cable sheath when pulling through. The Linolite system of lighting was well represented and the newest example of this system being the four-light tungsten electrolier made up of four units and powerful reflectors; the latter being placed parallel to the tubes of light, throw the rays over the entire space to be illuminated with no under-shadow. These new electroliers are fitted with either tungsten or carbon lamps. The silver-plated reflector for picture frames and many new types of desk and table lamps, were among the other types of Linolite lamps shown. A complete line of high-grade porcelain insulators adapted for all purposes and voltages were shown. The "Giant" strain insulator was represented by several sizes. Many kinds of insulating materials for various kinds of apparatus together with special plugs for heating devices and cooking utensils were on exhibition. Samples of Electrobestos, molded mica weatherproof lamp sockets, "Enos" fixtures and "Opalux" reflectors, friction tapes and splicing compounds, etc., came in for their share of the exhibition. The exhibit was in charge of H. M. Frantz, assisted by George A. Saylor, W. E. Rapp and R. C. Cole.

W. N. Matthews & Brother, St. Louis, Mo., showed working exhibits of their guy anchor, pole erector, cable clamp, holdfast lamp guard, easy lamp changers, easy cord adjuster, cable clips, cable splicing joints, cable roller and linemen's protector shields. A book of specifications on underground conduit was distributed to delegates. This book contains ninety-six pages, about sixty of which contain useful information, cost figures and drawings, to enable anyone to lay out a conduit system in accordance with the most approved methods. W. N. Matthews, Claude L. Matthews, Victor L. Crawford, Walter E. Bishoff and H. E. Marshall represented this firm.

The Metropolitan Engineering Company, Brooklyn, displayed a complete array of Murray meter protective devices, such as seals, porcelain fuse plugs, cut-outs, terminal protectors, to prevent theft of current. A number of models of the company's electric signs were also shown. R. M. Mann was present on behalf of the company.

The Minerallac Electric Company, Chicago, besides showing varieties of its well-known Minerallac electrical compound, made an exhibit of the Chicago printing attachment for meters, which actually prints the meter reading at intervals of one hour on a strip of paper. Some instruments with an adjustable interval were also shown. F. F. Kinney and G. F. Oliver explained the printing attachments and looked after the company's other interests.

The Moloney Electric Company, St. Louis, exhibited an extensive line of its transformers, including some fifty units, among which were pole-type, subway, high-voltage water-cooled, and many other standard types of transformers, besides auto-transformers, potential and current instrument transformers, low-voltage transformers and other special types T. O. Moloney, J. J. Mullen, J. H. Gordon, H. J. Vogt and H. A. Albrecht represented the company.

The Monolithic Conduit Company, St. Louis, showed a number of lengths of concrete conduit which had been constructed in the trench on its customary plan and dug up for the exhibition. The method of construction and its advantages were explained by E. C. Freeze.

The National Electric Lamp Association, Cleveland, through its enginneering department, made an exceptionally complete exhibit of Mazda incandescent lamps which created much interest. Among these were the standard 110-volt lamps with carbon, Gem tantalum and tungsten filaments, a variety of series street lamps, sign lamps, miniature and low-voltage lamps, automobile and train-lighting lamps, etc. A series of charts were shown that related to the cost of lighting for various classes of consumers with different types of lamps. These charts were used to illustrate the paper Mr. Doane read before the convention. Among the staff of the engineering department present were: S. E. Doane, G. C. Webster, W. M. Skiff, P. F. Bander, G. S. Merrill, H. S. Hall, J. D. Hoit, M. D. Cooper, C. O. Brandel, A. J. Hitzker and R. E. Scott.

The Otis Elevator Company, New York, exhibited an elevator machine driven by a single-phase motor and controlled by a set of push-buttons. H. S. Wells represented the company.

The Philadelphia Electrical and Manufacturing Company, Philadelphia, had a line of lighting appliances on view consisting of fuse boxes, cut-outs, metallic conduit joint wrappers, locust pins, incandescent street-lighting fixtures, etc. An attractive display of tungsten "arcs" was also made. C. L. Bundy and W. O. Dale were in charge of the exhibit.

The Pittsburg Transformer Company, Pittsburg, showed a line of its standard transformers for high voltage and heavy duty. Small high-voltage instrument transformers for use with switchboard instruments were also shown. The company was well represented by H. G. Steele, R. V. Bingay, P. H. Butler, L. H. Briggs, C. R. Lininger, L. C. Mitchell, F. T. Wyman and G. H. Horne.

The Rauch & Lang Carriage Company, Cleveland, exhibited a forty-cell electric coupe, whose merits were explained by H. J. Killins and C. E. Michel.

The Ricker Manufacturing Company, Rochester, N. Y., showed a commercial installation of its oil-fuse box in connection with a full-sized pole and manhole for a three-phase distributing system. There was also a cable junction box installed in the manhole. The Rochester meter and service box to prevent theft of current was shown, as were several samples of Rochester non-freezing fuse oil. George Hearn was in attendance.

The Sangamo Electric Company, Springfield, Ill., displayed a number of its watthour and ampere-hour meters for residence and switchboard use. These were shown connected to clusters of lamps so that the

energy consumed could be easily read when the lamps were turned on. As all these meters are of the mercury-motor type, a large model of the Faraday disk illustrating this principle was shown. The company was represented by J. Bunn, R. C. Lanphier, I. A. Bennett, J. H. Hodde, A. D. Birnbaum, S. Lynn and F. Pride.

The Simplex Electric Heating Company, Cambridge, Mass., had two booths for the display and demonstration of its numerous heating appliances. Among these were water heaters, heating pads, toasters, percolators, chafing dishes, tea kettles, disk stoves, ranges, flatirons, etc., for household use; as well as a full line of tailors' and laundry irons, soldering irons, glue pots, and a number of other appliances for industrial use. A new feature of the Simplex stoves is that the utensils are separable from the stove proper, so that they may be easily and rapidly clamped to the to the heating element. The utensils are also made interchangeable in this way, but may be easily and rapidly clamped to the stove so as to make an efficient unit. The flatirons are provided with flexible suspension arm and automatic cut-out stand. The interests of the company were looked after by J. I. Ayer, H. L. Hixon, H. F. Holland and E. R. Jacobs.

The Standard Underground Cable Company, Pittsburg, made an extensive display of its several types of cables for various uses. A variety of samples of the insulations used were shown. Cable accessories, such as terminals, junction boxes, cable hangers, jointing compound, etc., also formed part of its exhibit, which was in the care of J. R. Wiley, R. C. Houck, B. S. Stewart, E. J. Pietzcker, C. J. Marsh, J. H. Lytle and A. A. Anderson.

The Star Electrical Concern, New York, showed five of its various types of flaming arc lamps suitable for either direct-current or alternating-current circuits. Two indoor lamps provided with Edison screw base and equipped with prismatic reflectors were shown. The outdoor lamps were provided with different types of reflectors for various kinds of distribution. W. H. Gardiner represented the company.

The Studebaker Automobile Company, South Bend, Ind., exhibited a landaulet with folding front, a victoria phaeton and a 1,500-pound delivery wagon. A number of the company's gasoline cars were freely provided for the convention delegates; these were in charge of expert chauffeurs. Among the company's representatives were: J. M. Hill, W. Hunnewell, A. Kelly, W. P. Kennedy, E. W. Curtis, C. F. Redden, W. J. Donlan, H. Eames, D. F. M. Weeks, A. R. Davis, L. Kuhns, C. Quigley, C. Weaver and E. Michael.

The Tungstolier Company, Cleveland, made a striking exhibit of a five-lamp folding tungstolier fully lighted and so arranged that a hidden motor raised and lowered the arms of the fixture. An array of the company's publications disclosing its wide-awake methods of exploiting its wares and at the same time benefiting central stations was on hand for distribution. Further details were supplied by H. Kulas, W. H. Fisher and F. C. Maxheimer.

The United States Light and Heating Company, New York, showed a complete line of all types of its batteries, including stationary cells installed in glass jars and lead-lined tanks, sparking batteries, vehicle batteries, the new National auto-lighter battery for ignition and lighting, and a complete equipment of car-lighting cells. The exhibit was in charge of A. H. Ackermann, J. Allen Smith, C. C. Bradford, W. F. Bauer and B. Smith.

The Wagner Electric Manufacturing Company, St. Louis, made an attractive exhibit of its motors and transformers. The motor display included a ten and a fifteen-horsepower three-phase motor, the latter being a vertical machine with effective oiling device for its bearings, also a single-phase motor arranged to show clearly the action of the automatic governing device which removes the brushes of the motor after it has started as a repulsion machine. The coils and core of a shell-type and of a core-type transformer were also displayed. Among the Wagner officials present were W. A. Layman, Walter Robbins, W. S. Thomas, F. N. Jewett, V. W. Bergenthal, A. H. Timmerman, C. B. Lord, John Mustard, E. H. Cheney, E. W. Goldschmidt, Dean Emerson, O. H. Davidson, F. Johnson, T. T. Richards, E. D. Pike, J. F. Jones, J. W. Westcott, W. W. Briscoe, M. Hearn, C. M. Duncan, Ray Flagg, E. Ballman, O. Weimer, H. Weichsel, E. L. Coolidge, S. Sparrow and Ray D. Lillibridge.

The Warner Arc Lamp Company, Wilton Junction, Ia., showed a number of its flaming arc and inclosed arc lamps, as well as several of its so-called tungsten "arcs." The latter comprise clusters of low-voltage tungstens arranged to resemble the inclosed arc lamp both in appearance and illuminating power. W. F. Warner and C. K. Ross were in charge of this booth.

The Waverley Company, Indianapolis, Ind., exhibited a four-passenger brougham and a mounted Waverley high-efficiency shaft drive showing the complete driving mechanism of the car in operation. The herringbone gears used in this drive are of the same general pattern as those employed in the building of marine turbines, which recent experiments have shown to possess an average efficiency of 98.7 per cent. W. C. Johnson and L. C. Voyles represented the company.

The Wesco Supply Company, St. Louis, showed a number of its specialties, among which were the Steiner household motor for driving a variety of household machines, such as vacuum cleaners, sewing machines, washing machines, wringers, ice cream freezers, etc. A number of oscillating desk and bracket fans were shown, also several Triumph motors, Allen-Bradley motor starters, Adams-Bagnall regenerative flaming arc lamps, etc. A number of the company's officials were on hand to explain these devices.

The Western Electric Company made a comprehensive exhibit of telephones, power apparatus, arc lamps and central-station supplies. The telephone exhibit consisted of various types of the Bell instruments and also various types of interphones for interior service. The power apparatus included alternating-current and direct-current motors of various sizes, sewing-machine motors, fan motors, ventilating equipments and transformers. The arc lamp display consisted of Hawthorn flaming arcs, Solaris arcs and the Hawthorn inclosed carbon arcs. Those in attendance at the exhibit were E. W. Rockafellow, F. D. Killion, F. X. Cleary, W. L. Stockton, H. L. Grant, L. T. Milnor, C. H. Talmage, G. E. Cullinan, E. Devine, W. J. Doherty, L. F. Philo, Burt Crouch and P. A. Morse.

The Westinghouse exhibit included displays by the Westinghouse Electric and Manufacturing Company, the Westinghouse Machine Company and the Westinghouse Lamp Company. The first displayed a representative line of its smaller apparatus. Direct-current motors were represented by type S motors for general industrial service; alternating-current motors by the type A single-phase, the type HF phase-wound secondary, and type MS squirrel-cage secondary motors. This latter motor has just recently been placed upon the market and is designed for severe industrial service where a heavy and practically indestructible motor is required. The small motors were shown in sizes from one-twelfth to one-quarter horsepower for both direct and alternating-current circuits, together with a complete line of buffing and polishing motors. Controlling apparatus for both direct and alternating-current motors was shown, including the new auto-starter for squirrel-cage motors. There was also displayed a complete line of alternating and direct-current arc lamps, including both multiple and series types, and a line of heating apparatus comprising several sizes of luminous radiators, air heaters, toaster stoves, disk stoves, domestic sadirons, tailors' irons and other apparatus. Several types of lightning arresters for both high and low voltage were also shown. One feature was the new automatic type of mercury rectifier used for charging automobile storage batteries and shown in operation. This rectifier was connected so that the load could be gradually decreased from about twenty amperes to five amperes to show the automatic feature by which the rectifier cuts out when the batteries are fully charged. Another feature was the new type of automatic-voltage regulators which were connected into the service that supplied power to the building and maintained the voltage uniform regardless of the current variations. The Westinghouse Lamp Company featured its newest type of tungsten lamps which has just been placed upon the market, namely, the wire type of continuous filament lamp. The manufacture of these filaments has been so improved that instead of four or six hairpins of tungsten, there is but one long wire of tungsten. The 500, 250, 150, 100 and sixty-watt types were shown burning. The forty and twenty-five-watt types were shown in a lay exhibit, as it is expected that they will soon be on the market as well as the larger sizes. There was also a complete display of all sizes of the 110 and 220-volt tungsten lamps, as well as several types of low-voltage and sign-lighting tungsten lamps. The latter were operated from economy coils and sign-lighting transformers. There were also several types of street series tungsten and automatic tungsten lamps as well as special sizes and carbon-filament lamps. Among those in attendance at the exhibit were the following: L. A. Osborne, S. L. Nicholson, C. S. Cook, Chas. Robbins, G. B. Griffin, J. C. McQuiston, E. H. Sniffin, C. C. Chappelle, A. A. Rogers, Walter Cary, T. G. Whaling, B. F. Fisher, Jr., and W. Barnes, Jr., the latter being in charge of the exhibit.

The Yawman & Erbe Manufacturing Company, Rochester, N. Y., showed an electrically operated copying machine and a filing cabinet, which Mr. Cole pointed out as particularly adapted for use by central-station companies.

Among those attending the convention and the manufacturers' exhibition, although in some cases not identified with an exhibit, were the following: A. H. Ackerman, United States Light and Heating Company; Joseph F. Becker, sales manager, United Electric Light and Power Company, New York; Chas. Blizard, vice-president, Electric Storage Battery Company; N. F. Brady, vice-president, New York Edison Company; C. L. Bundy, secretary and treasurer, Philadelphia Electric and Manufacturing Company; N. C. Cotabish, sales manager, National Carbon Company; L. H. Conklin, Manila Electric Railway and Light Company; J. Robert Crouse, Jr., sales manager, National Electric Lamp Company; H. H. Cudmore, president Brilliant Electric Company; Mr. and Mrs. A. J. DeCamp; Philip S. Dodd, director of publicity National Electric Lamp Association; Henry L. Doherty, H. L. Doherty Company; C. A. Du Bosch, manager Hugo Reisinger; Hayden Eames; A. C. Garrison, president Columbia Incandescent Lamp Company; F. H. Golding, general manager Rockford (Ill.) Electric Company; J. M. Hill, Studebaker Company; Mr. and Mrs. H. M. Hirschberg, Excello Arc Lamp Company; Arthur S. Huey, vice-president H. M. Byllesby Company; W. L. Kline, American District Steam Com-

pany; E. Kuhlman, Kuhlman Electric Company; E. J. Kulas, president Tungstolier Company; P. S. Klees, Franklin Electric Manufacturing Company; Mr. and Mrs. J. A. Lovejoy, vice-president General Electric Company; Q. O. Moloney, president Moloney Electric Company; George T. Manson, Okonite Company; Romaine Mace, Okonite Company; Mr. and Mrs. A. H. Patterson, vice-president Phoenix Glass Company; H. C. Rice, General Incandescent Company; M. S. Seelman, Jr., Edison Electric Illuminating Company of Brooklyn; Frank W. Smith, secretary United Electric Light and Power Company, New York; Mr. and Mrs. Russell Spaulding, W. D. Uptegraff, vice-president Nernst Lamp Company; Max Harris, sales manager Nernst Lamp Company; J. H. Vail, General Vehicle Company; Wm. C. Woodward, Narragansett Electric Lighting Company; Mr. and Mrs. Arthur B. Lisle, general manager Narragansett Electric Lighting Company; L. P. Sawyer, secretary Buckeye Electric Company; J. G. Pomeroy, Adams-Bagnall Electric Company; T. E. Adams, Adams-Bagnall Electric Company; S. G. Rhodes, New York Edison Company; Mr. and Mrs. E. H. Haughton, Bryan-Marsh Company; J. S. Corby, manager Monarch Incandescent Lamp Company; M. Lobenthal, Economical Electric Lamp Company; L. Lobenthal, Economical Electric Lamp Company; H. B. Logan, president Dossert & Company; W. J. Donlan, Studebaker Company; D. J. Burns, vice-president and sales manager Ward-Leonard Electric Company; Elliott-Reynolds, Doubleday-Hill Electric Company; Paul Stewart, treasurer and manager John A. Stewart Electric Company; Charles W. Brainerd, Franklin Electric Manufacturing Company; A. G. McClure, American Conduit Company; Mr. and Mrs. G. W. Armstrong, Excello Arc Lamp Company; W. R. Bonham, Sterling Electric Manufacturing Company; Harold Almert, H. M. Byllesby & Company; W. K. Archbold, president Archbold-Brady Company; W. L. Arnold, vice-president Arnold Company; G. H. Atkins, Electric Storage Battery Company; C. C. Baird, H. B. Camp Company; F. C. Bates, General Electric Company; Paul F. Brander, National Electric Lamp Association; P. R. Boole, sales manager Electric Appliance Company; H. W. Young, president Delta-Star Electric Company. E. L. Callahan, H. M. Byllesby & Company; Alex. J. Campbell, general manager New London Gas and Electric Company; P. C. Chrysler, General Vehicle Company; V. L. Crawford, W. N. Matthews & Brother; J. S. Crider, National Carbon Company; Wm. P. Crockett, president Wm. P. Crockett Company; S. F. Dibble, General Electric Company; Wm. A. Donkin, Allegheny County Light Company; J. F. Dostal; Alex. Dow, general manager Peninsular Electric Light Company; C. L. Eshleman, Jandus Electric Company; J. B. Estabrook, Colonial Electric Company; E. H. Fox, Phoenix Glass Company; Dr. K. G. Franke, Siemens-Schuckert & Company; R. E. Gorton, New York and Ohio Company; George H. Harries, vice-president Potomac Electric Power Company; Alex. Henderson, American Circular Loom Company; S. A. Hobson, Wesco Supply Company; F. J. Hovey, Stone & Webster; Charles A. S. Howlett, General Electric Company; C. A. Howe, Chicago manager Holophane Company; Dana H. Howard, advertising manager Commonwealth Edison Company; George B. Johnson, Commonwealth Edison Company; Claude H. Johnson, vice-president Curtis Advertising Company; R. P. Keasbey, H. B. Camp Company; E. Kirkpatrick, general manager Kirkpatrick Conduit Company; P. H. Korst, secretary-treasurer Janesville Electric Company; R. C. Lanphier, secretary and manager Sangamo Electric Company; V. R. Lansingh, general manager Holophane Company; C. W. Lee, C. W. Lee Company; R. D. Lillibridge, advertising manager Wagner Electric Manufacturing Company; E. W. Lloyd, contract agent Commonwealth Edison Company; John W. Mabbs; R. H. Manwaring, Philadelphia Electric and Manufacturing Company; Converse D. Marsh, Bates Advertising Company; L. D. Mathes, Union Electric Company; R. K. Mickey, Novelty Incandescent Lamp Company; Preston S. Millar, Electrical Testing Laboratories; Cyril Nast, New York Edison Company; Homer E. Niesz, manager Cosmopolitan Electric Company; N. L. Norris, general manager Banner Electric Company; A. D. Page, General Electric Company; F. W. Pardee; Frank L. Perry; E. J. Pietzcker, Standard Underground Cable Company; Frank B. Rae, Jr., Rae Company; Mark A. Replogle; S. Scovil, vice-president and treasurer Cleveland Electric Illuminating Company; C. F. Scott, consulting engineer Westinghouse Electric and Manufacturing Company; H. A. Seymour, Commonwealth Edison Company; Oliver Shiras, International Supply Company; James J. Sorber, Nernst Lamp Company; L. G. Van Ness, Merchants Power Company; R. M. Van Vleet, Cutler-Hammer Manufacturing Company; Herbert M. Vanzwell, National Electric Lamp Association; C. E. West, Fairbanks, Morse & Company; C. W. Wilkins, National Carbon Company; Harold J. Wrape, American Carbon Battery Company.

The delegates from Illinois to the number of eighty-one, met upon the call of President N. M. Argatrite, of the Illinois Association, at the Rathskeller of the American Hotel on Wednesday evening for an informal dinner together and enjoyed a thoroughly sociable time.

The *Convention Daily* was one of the most interesting features of the convention. The reports of proceedings were well handled, and the news items and incidental matter was of a bright, readable and thoroughly enjoyable nature. The editors worked hard and Managing Editor W. E. Keily is entitled to our warmest congratulations.

Souvenirs were conspicuous in their absence, only a few companies distributing anything in the form of a convention token. The Okonite Company distributed leather purses and hard rubber pen racks. The Phoenix Glass Company distributed small drinking glasses. The Studebaker Company and the Otis Elevator Company distributed leather match cases. The John A. Stewart Electric Company distributed stone ink blotters, and the Pittsburg Transformer Company distributed thousands of its famous "stogies." The Duncan Electric Manufacturing Company distributed lead pencils.

The "Convention number" of "The Edison Round Table," published at St. Louis by the Commonwealth Edison Branch of the National Electric Light Association, was a fine example of enterprise and journalistic possibility. The text was highly interesting and the cartoons greatly enjoyed. The good work of Editor Edkins and Business Manager Dana H. Howard was warmly commended.

Chicago Electric Club.

The regular weekly meeting of the Chicago Electric Club, held on May 25 at the Kuntz-Remmler Hotel, was in the form of a Dutch lunch. The meeting was well attended in spite of the fact that at that time many of the electrical men of the city were attending the convention of the National Electric Light Association in St. Louis.

Through the efforts of Geo. H. Porter, chairman of the entertainment committee, the members were entertained by an excellent program which fitted in very well with the lunch. In addition to the numbers given by the entertainers, several members, called upon by Mr. Vose, made remarks appropriate to the occasion.

Bids for Lighting Plant.

Bids will be received by the City of Tyndall, S. D., for an electric-light plant and improvements to the water works. Figures will be called for on forty and fifty-five kilowatt generators, gas-producer plant for driving the same, and 50,000-gallon concrete reservoir. Letting will be held at the office of the city auditor, H. B. Phoenix, on June 15, 1910, at 7 p. m. F. A. Morgan is mayor of the city, and Oscar Claussen of St. Paul, Minn., is the consulting engineer, to whom enquiries may be directed.

Commercial Telegraphers' Union.

Through the efforts of the Chicago Association of Commerce, the Commercial Telegraphers' Union of America will hold its annual convention in Chicago on June 15. About one thousand delegates from all parts of the United States will be in attendance.

Lectures on Illuminating Engineering at Johns Hopkins University.

A course of thirty-six lectures on Illuminating Engineering will be given at Johns Hopkins University, Baltimore, Md., upon the initiative of the council of the Illuminating Engineering Society. These lectures which will extend from October 26 to November 8, will among other things give to practising engineers an opportunity to obtain a conception of the science of illuminating engineering as a whole.

The lectures will be given under the joint auspices and control of the Society and the University and will follow immediately the annual convention of the Society which is to be held at Johns Hopkins University beginning Monday, October 24.

Credit for this interesting series of lectures is largely due to the committee of the Society, on lectures, consisting of Louis Bell, W. H. Gartley, L. B. Marks, C. H. Sharp, W. D. Weaver and E. P. Hyde.

MAGNETIC HYSTERESIS IN A ROTATING FIELD.

BY M. G. LLOYD.

The ferromagnetic metals are distinguished by the property of retaining permanently a condition of magnetization after the magnetizing field has ceased to act upon them. This is coupled with the fact that their magnetic condition bears an inconstant ratio to the magnetizing field. In other words, the permeability is not constant, but depends upon the previous magnetic treatment of the specimen. The value of the magnetic flux corresponding to a given magnetizing field is always greater when the given field is approached from a higher value than when it is approached from a lower value. This phenomenon, known as hysteresis, was discovered by Warburg in 1880, and he showed that, as a result of it, an expenditure of energy is necessary to carry the magnetic material through a cyclic series of magnetic conditions. This energy appears in the material in the form of heat.

Many investigators have studied the phenomenon of hysteresis, using magnetising fields which could be increased or decreased by steps, or else using fields which rapidly reverse in direction, as produced by an alternating current. The most notable results are those of Ewing and of Steinmetz. The latter established the approximate empirical relation that the energy expended per cycle is determined by the maximum flux density of the cycle followed and is proportional to this flux density raised to the 1.6th power; and since it is also proportional to the volume, he expressed the power by the equation

$$W = z\, n\, V\, B^{1.6}$$

where V is the volume, B is the maximum flux density and W the power transformed when the frequency is n cycles per second. Z is a constant depending upon the material used. This formula holds fairly well for iron and steel through the range of flux density used mostly in industrial applications, and has proved very useful in practice, but it is not to be regarded as expressing a natural law, as it does not hold for very high or low flux densities, and the exponent is seldom exactly 1.6 even in moderate fields, but varies for different specimens.

When an alternating field is used to carry the magnetic material through a cycle of values, there is a second source of energy transformation, made manifest by the eddy currents in the metal. The result of these is to further increase the heating of the material with a corresponding loss of energy in the magnetizing circuit.

If instead of using a field which simply alternates in direction, we subject the magnetic specimen to a rotating field, such as may be produced by polyphase currents, a somewhat similar effect is produced, although the conditions are different. The material is now constantly magnetized, the field never being reduced to zero value, but the direction of magnetization is continually changed. Here again there is a lag of magnetization behind the magnetizing field, but the lag is a lag in direction, not in magnitude. This rotary hysteresis requires an expenditure of energy, as in the other case, but the amount of energy transformed is not the same, for a given value of the maximum flux density. Eddy currents are produced in this case, also, and aid the transformation of energy into heat, but in what follows it is the energy due to the hysteresis that is to be considered. As in the case of the alternating field, the two sources of energy loss can be distinguished by taking observations at two different frequencies Since power expended in hysteresis is proportional to the number of cycles per second, whereas the power expended in eddy currents is proportional to the square of the frequency, the separate values can be easily computed from two such observations.

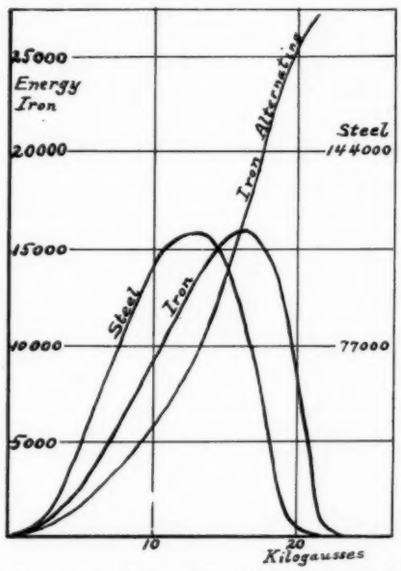


FIG. 1—ROTARY HYSTERESIS FOR IRON AND STEEL.

The hysteresis in a rotating field was first observed by Baily, who showed in 1894 that if a magnet was rotated about an iron armature, the latter experienced a torque in the direction of rotation. The armature used was finely laminated, in order to avoid eddy currents as far as possible.

The torque was measured by balancing it against a spring, and the hysteresis was thus determined. The hysteresis was found to increase with the flux density in moderate fields, but finally reached a maximum and decreased to zero when the field was made sufficiently intense. This result was obtained with both soft iron and hard steel, and was a confirmation of Ewing's theory, which explains magnetic phenomena by the mutual action of the elementary magnets which must be regarded as constituting a magnetic substance.

Beattie made similar experiments upon nickel and cobalt, with similar results. In nickel, a maximum hysteresis loss of nearly 10,000 ergs per cubic centimeter per cycle was observed with a magnetizing field of 340 gausses. In cobalt a maximum of about 36,000 ergs per cubic centimeter per cycle was observed and in both cases the plotted curves indicated that the hysteresis would reach zero if the flux were carried to the saturation value.

Beattie and Clinker found that for iron the hysteresis reached a maximum for a flux density of 16,000 gausses, and then decreased, reaching zero at about 25,000 gausses.

Schenkel experimented by rotating the specimen in a steady field, and measured the torque by a form of transmission dynamometer. His results were similar to the above.

Grau and Hiecke found a maximum hysteresis in iron at a flux density of 13,600 gausses.

In 1908, Weiss and Planer conducted some experiments with a rotating magnet which were somewhat more refined than the previous work. The specimens were in the form of disks, and when placed horizontally were subjected to a rotating field, but when placed vertically, the effect was the same as an alternating field. Observations were made upon steel, iron, nickel and pyrrhotite. They found, like pre

vious observers, that for low fields the hysteresis was greater in the rotary field than in the alternating, but after passing a maximum the hysteresis in the rotating field finally decreased to zero, as the material reached saturation. Fig. 1 shows some of their results, the energy being expressed in ergs per cubic centimeter.

The ratio of rotary to alternating hysteresis was found to be largest for the weakest fields, and had a value of 3.6 for nickel. This ratio decreased continuously, as the field was increased, except in the case of steel, where it at first increased and then decreased.

During the past year two researches have appeared showing the variation of rotary hysteresis with temperature.

Fuller and Grace used two-phase alternating current to produce the rotary field, while Perrier used apparatus similar to that of Weiss and Planer at Zürich. Both used electric heating coils to obtain the higher temperatures.

Both sets of experiments show that the maximum hysteresis in the rotary field decreases with increasing temperature, and that this maximum is reached with a lower flux density. Thus for iron at 580 degrees this maximum occurs at 10,500 gausses, while at temperatures below 340 degrees it occurs at about 16,000 gausses. Since the saturation value is also reduced by increasing the temperature, it was to be expected that the hysteresis would decrease to zero for a lower magnetization and this was found to be the case.

Perrier worked with nickel, magnetite and three kinds of iron and concluded that the ratio of the maximum values of the two kinds of hysteresis was characteristic of the material and independent of the temperature.

In some recent experiments Herrmann has adopted a different method of measuring the energy and gets results entirely different from previous observers. By means of a thermal couple he observes the rise of temperature in the specimen in a given time, usually fifteen minutes, and takes this as a measure of the energy expended due to hysteresis and eddy currents. He does not claim high quantitative accuracy for this method, but insists that it would indicate a maximum and a later lowering of the curve if such existed. Fig. 2 shows his results in arbitrary units. No maximum is evident in these curves. In Fig. 3, the energy per cycle is taken as ordinate, and the separation of hysteresis and eddy current losses thereby effected. The intersection of each curve with the vertical axis gives the hysteresis for that particular flux density, and these intercepts are seen to increase with the flux density up to 27,000 gausses, the highest value employed. He concludes that the hysteresis in a rotary field is therefore no different from the hysteresis in an alternating field.

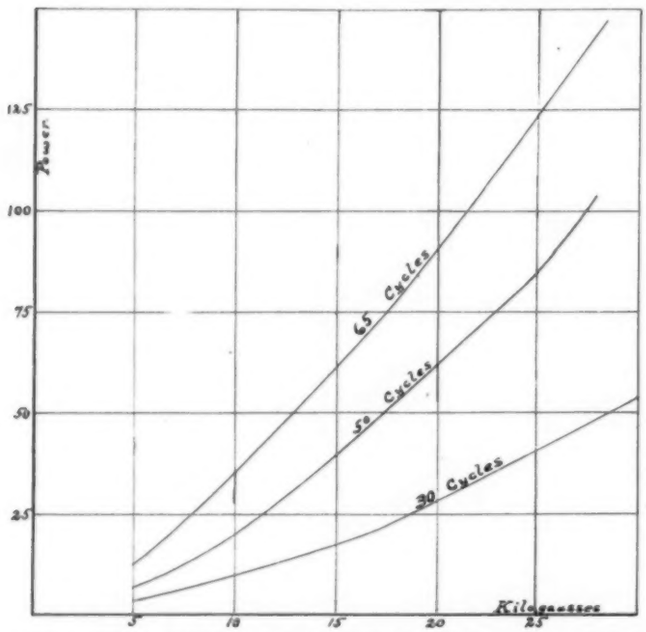


FIG. 2—TOTAL POWER EXPENDED IN ROTARY FIELD, BY HERRMANN'S METHOD.

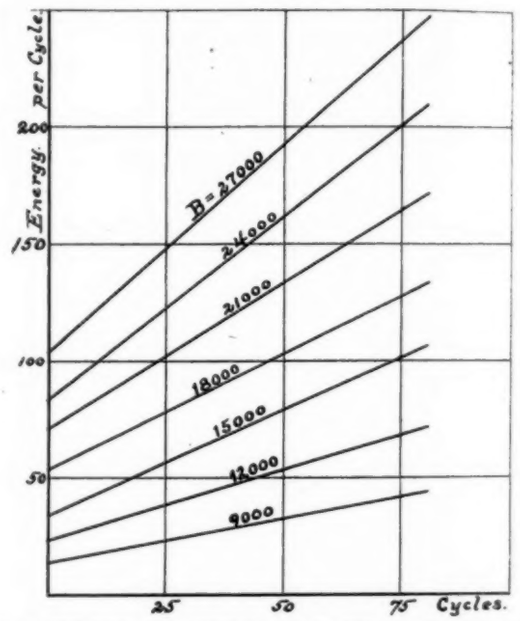


FIG. 3—ENERGY PER CYCLE COMPUTED FROM RESULTS IN FIG. 2.

Electric Show in Montana.

The Montana State College Branch of the American Institute of Electrical Engineers gave its third annual eletrical show in the laboratory and drafting rooms of the electrical department of the college on May 20. Nearly two thousand people were in attendance and showed great interest in the display.

In addition to the apparatus belonging to the department several manufacturing companies had their products on exhibition. The exhibitors were as follows: General Electric Company, tungsten and tantalum lamps, small motors, electric lighting fixtures, electric household appliances; Westinghouse Electric & Manufacturing Company, cooking and heating appliances; Benjamin Electric Company, electric lighting fixtures. The American Vulcanized Fiber Company and the National Metal Molding Company both displayed their products. The Madison River Power Company, Butte, Mont., exhibited an electric kitchen with a demonstrator at work showing the application of electricity in the preparation of food.

The Montana State College is located at Bozeman, Gallatin County, Montana, and has an annual enrollment of about four hundred students. Courses are maintained in civil, electrical, mechanical, sanitary and chemical engineering, chemistry, physics, mathematics, history, literature, pharmacy and the

various branches of agriculture. One day each year is set apart for the entertainment of visitors and the electrical show is the principal feature of the entertainment. The show is marked by an increasing attendance each succeeding year.

Continental Rubber Company Buys Mexican Property.

The Guayale rubber factory at Torreon, Mex., which is located in one of the largest Guayale producing territories, has been sold together with the rubber growing land for a sum of $15,000,000 gold. The purchaser is the Continental Rubber Company, in which John D. Rockefeller, Jr., of New York, is one of the largest stockholders.

The Guayule rubber holdings of the Madero family which now pass into the hands of the Continental company, consist of four factories, which have an annual output of about 6,000,000 pounds of crude rubber, and 2,000,000 acres of land upon which the Gayule shrub grows.

This transaction places the Continental Company practically in control of the Guayule rubber industry. It is estimated that it now has about $30,000,000 gold invested in Guayule rubber factories and lands in Mexico. It will erect several more large factories for converting the raw shrub into crude rubber.

A Magnetic Balance.

A paper on "The Magnetic Balance of MM. Curie and C. Cheneveau, by C. Cheneveau, with an Appendix by A. C. Jolley," was read before the Physical Society of London, England, on April 22 last, by A. C. Jolley. This balance is intended for the determination of the coefficient of specific magnetization, susceptibility, and permeability of feebly paramagnetic and diamagnetic bodies. The body under investigation is suspended from one arm of a torsion balance, which measures the force exerted on the body when it is placed in the non-uniform field of a permanent magnet. The torsion balance is formed by a horizontal rod suspended by a long fine platinum wire and carrying at one end a hook from which the substance under investigation can be suspended in a small inclosing glass tube. On the other end of the torsion arm a copper sector is fixed which moves between the poles of an auxiliary magnet and thus provides efficient damping. A second branch arm is also provided upon which may be placed suitable counterweights to balance the specimen. The suspension carries a mirror, and the movements are read on a translucent scale in the ordinary way. The magnetic field is that of a large circular permanent magnet mounted in such a way that the vertical gap may be made to describe a semicircle of radius equal to the length of the torsion arm, and the movements of this magnet are controlled by the observer at the screen by means of cords. An empty containing tube is first mounted on the balance, and the maximum deviation of both sides of the zero is obtained by bringing up the magnet towards each side of the specimen. The tube is now filled to a given mark with a known mass of pure distilled water and the variations observed as before The water is now replaced by a known mass of substance to be examined occupying the same volume or the same vertical height, and again the deviations are observed. The paper indicates how the value of K may be calculated from these observations. Experiments have been performed with various metals and alloys, and the results are tabulated and discussed in the paper.

Merritt Bill Passes.

The Merritt bill, which provides for the regulation by the Public Service Commission, of all telegraph and telephone companies in the Second District of the State of New York, passed the Senate at a recent session. It has only to be approved by Governor Hughes.

Power is given to the commission by this bill to issue orders in relation to rates and service. This authority, the bill stipulates, shall not be construed as giving the commission power to make an order requiring a telegraph or telephone company to perform any act which is unjust or unreasonable or in violation of the requirements of its franchise or of any State or Federal law.

The commission receives the power of investigation and limited control over the forms of accounts and records of the companies, which are required to file annual reports with the commission. The commission is given the veto power over the exercise by the companies of rights and privileges under the franchises, which they have not exercised up to this time.

The measure contains provisions against discriminations in rates. It prohibits any corporation or association other than a telephone or telegraph company, to acquire more than ten per cent of the stock of any telephone or telegraph company.

The bill prohibits the granting of reduced rates or free passes or franks for transmission of any messages except by employes of the companies.

The bill requires that the permission and approval of the commission shall be given for issues of stocks and bonds, except that companies may issue notes payable otherwise than on demand for proper corporate purposes without the approval of the commission, and notes to be payable at specified periods of not more than twelve months.

Wireless Between France and Nova Scotia Assured.

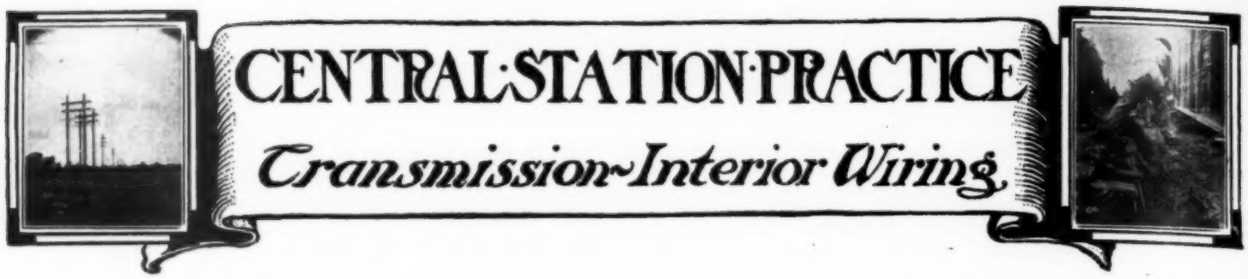
An interesting announcement, made by William Marconi on his departure to England from Montreal, was that the English wireless company has concluded an arrangement between the Canadian company and the government of France for a direct wireless communication between Glace Bay, Nova Scotia and the French station. Mr. Marconi also stated that, early in the coming fall, it was his intention to begin a series of tests as to the practicability of throwing electric waves, charged with messages, over the Rockies to the Pacific Coast. He expressed himself as confident of success in this venture, as he had already performed the same feat over the Alps.

Atlantic & Suburban Railway Sold.

John L. Clawson and Norman Grey have sold the Atlantic & Suburban Railway Company to the Atlantic City & Shore Company of Atlantic City, N. J. The purchase price is close to $1,000,000, most of which is payable in four per cent trust certificates, subject to a prior lien or first mortgage of $100,000 at five per cent, the principal and interest of which are guaranteed by the Atlantic City & Shore Company.

Electric Power for Dredging.

The American Dredging Company has contracted with the Southern California Edison Company for electric power to be used for dredging San Francisco Harbor. A minimum amount of 12,000 horsepower is to be supplied at a minimum cost of $15,000 per year.



LOCALIZATION OF FAULTS ON UNDERGROUND MAINS.[1]

DESCRIBING A SIMPLE METHOD OF LOCATING EARTH LEAKAGES WITHOUT INTERRUPTING THE SUPPLY.

BY W. A. TOPPIN.

Much attention has been given of recent years to the design and manufacture of underground cables, with the result that cable can now be procured which, if carefully laid, will last for years, giving satisfactory service with little or no repairs. It is now generally recognized that the cable system is at least of equal importance with the generating station. If information were obtained on the subject, it would be found that more interruptions of supply have occurred through faults on cable networks and feeders than through all other causes combined. To insure continuity of supply the details of a cable system must be as carefully thought out and be subject to the same intelligent care and supervision as any portion of a power-station installation.

The following remarks on the localization of faults are not based on any particular theory, but are the result of the author's practical experience with a three-wire direct-current system, using single conductors, the distributors generally being laid solid in bitumen, and the feeders drawn into conduits.

The most fruitful source of trouble on such a system is that arising from earth leakages, which may occur on either of the outer conductors or on the middle wire. As a rule, these faults develop gradually, and unless localized at an early stage may result in a serious burnout, with possible interruption to the supply system. It is therefore wise to test and record carefully from day to day the condition of the mains, taking steps to localize and repair a leakage immediately it begins to indicate on the earth-recording ammeter. The author's experience shows that ninety per cent of mains faults originate in earth leakages, and these can nearly always be located and remedied before reaching the critical stage.

Causes of Faults.—Faults on cable systems may be classified under the following heads: (1) Those due to defects in the manufacture of the cable, such as cracks or pinholes in the insulating material. (2) Those due to improper methods, or careless handling of the cable when laying. (3) Those due to disturbance of the ground, either by subsidence or street openings by other departments.

Recording of Earth Leakages.—On all direct-current systems where the pressure between adjacent conductors exceeds 125 volts, the British Board of Trade stipulates the following conditions: (*a*) The connection with earth of the intermediate conductor shall be made at one point only on each distinct circuit—namely, at the generating station, substation, or transformer—and the insulation of the circuit shall be efficiently maintained at all other parts. (*b*) The current from the intermediate conductor to earth shall be continuously recorded, and if it at any time exceed one thousandth part of the maximum supply current, steps shall be taken immediately to improve the insulation of the system.

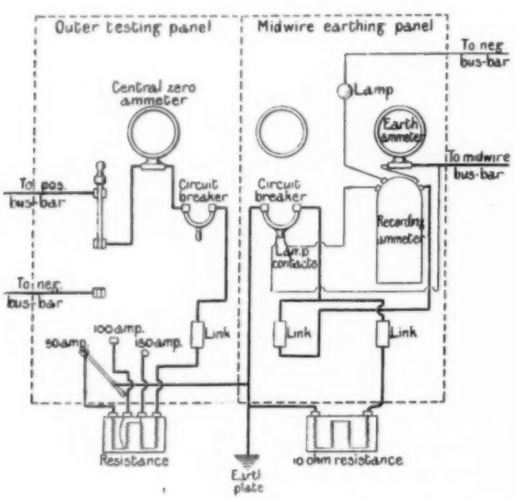


FIG. 1.—TESTING AND EARTHING PANEL, THE LATTER TO BRITISH BOARD OF TRADE REQUIREMENTS.

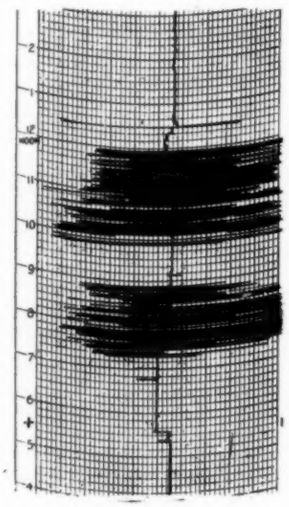


FIG. 2.—CHART FROM EARTH RECORDER.

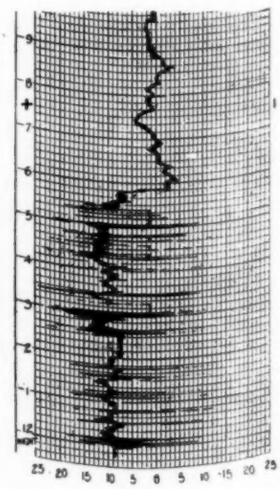


FIG. 3.—AMMETER RECORD OF EARTHING OF MAIN.

[1]Abstract of a paper read before the Glasgow (Scot.) Section of the (British) Institution of Electrical Engineers, May 10, 1910.

Fig. 1 shows a testing and earthing panel, the latter designed to meet the Board of Trade requirements. On the right-hand panel the middle-wire busbar of the station switchboard is connected through the indicating and recording ammeters, and thence through an automatic circuit-breaker to an earth-plate of ample dimensions. The cut-out is adjusted so that when the current flowing through it to earth exceeds twenty-five amperes the circuit is interrupted, and the current is shunted through a ten-ohm resistance. When open, the circuit-breaker arm closes a circuit through an indicating lamp and a relay on the recording ammeter, the latter actuating a needle to record the time during which the cut-out is open.

It was at one time questioned whether the insertion of a resistance in the earth did not transgress Regulation (*a*), but as the choice lay between the shutting down of one side of the system when a heavy earth fault occurred on an outer, or the limiting of the earth current by a resistance, the regulation has generally been construed in wider terms than may have been intended when originally framed. The left-hand panel has been designed for testing the insulation resistance of the outer conductors, the method being to earth each outer cable in turn through a known resistance, and noting the resultant current. It is also used to burn out minor earths which may occur on consumers' premises. If, for example, such a leakage is indicated on the negative outer, the procedure is to earth the positive busbar, and by passing a current, which can be varied by the regulating switch, the fault is burnt clear or localized by the melting of the consumer's fuses.

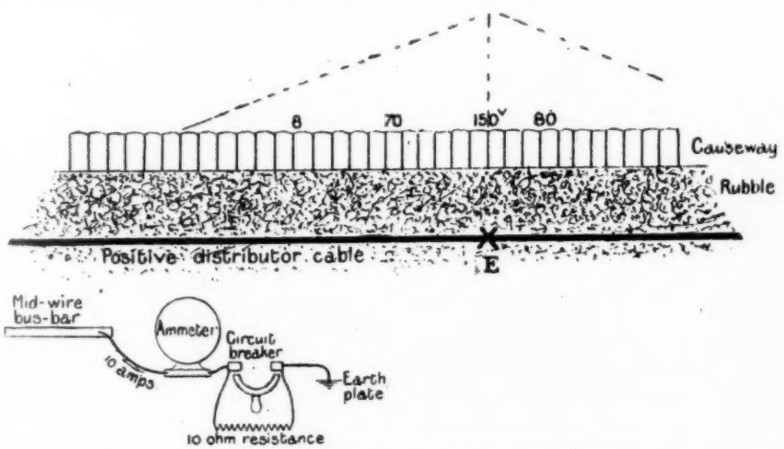


FIG. 4.—EARTHING ON A 250-VOLT THREE-WIRE SYSTEM.

In an industrial district where large power users are connected to the supply mains, and especially in places like shipyards and foundries, where temporary circuits are often run, many troublesome earth leakages occur, and a careful study of the earth chart will enable the mains engineer, with a knowledge of local conditions, to locate most of these faults. Overhead traveling cranes with bare trolley wires are responsible for many intermittent leakages. An example of this kind of earth is shown in Fig. 2, which is a reproduction from an earth recorder chart at the Greenock (Scotland) power station.

The ammeter record of a main's earth is shown in Fig. 3. This leakage was caused by a defect in the insulation of a feeder cable temporarily submerged in water. It is well known that negative cables are more susceptible to earth leakages than positive cables, and a record of the faults which have come under the author's notice during the last few years shows that fully eighty per cent of the earths on a supply system occurred on the negative side. In almost every case of breakdown in a negative conductor the core was found saturated with moisture for four feet or five feet deep on each side of the fault, due apparently to osmotic action, while the bitumen covering, which under normal conditions is unaffected by moisture, is converted into a spongy state, quite independent of its temperature. This peculiar effect is produced on the negative cable only, and in cases of faults affecting both outer conductors, the positive core was found to be quite dry, while the surrounding bitumen was in its normal state, or only affected by the heat generated by the leakage current. A positive earth fault on a feeder cable, which occurred in a draw-in box, due obviously to a crack in the bitumen sheathing, showed a gradually increasing leakage current for a period of three weeks, and on cutting out the faulty section the moisture appeared only to have crept for a few inches along the core on each side of the fault, while the bitumen was practically unaffected.

Locating Faulty Cables on Mains.—The location of faults is rendered easy where cable networks are divided into sections, with disconnecting links in convenient pillars. The proper method is to fuse each distributor cable at its feeder pillar, and in the event of the short-circuit the faulty section is automatically isolated from the system. Momentary short circuits which disturb the pressure are not of great enough duration to melt the fuses, and are consequently the most difficult to deal with. For this reason, among others, the author is of opinion that all feeders should be provided with ammeters on each conductor. A defect on the middle wire is not easy to locate, and introduces complications when an earth takes places on an outer, as the leakage current from the latter may be passing to the middle wire, and no indication given of the fault.

Many methods have been employed for the localization of faults on underground mains. In most cases the choice is limited by the type of cable and the system of supply. The author will not institute comparisons between these, but proposes to describe a simple method which he has found of service in locating earth leakages without interrupting the supply. He is not aware if the idea is novel or otherwise, but can testify from actual experience of its worth, and the chief claims he puts forward are its simplicity in operation and the absolute certainty of the results obtained by its use. Its operation depends on the fact that when an earth leakage occurs, the earth in its vicinity is charged to a potential above normal earth potential, and this potential will vary at any point in inverse proportion to the distance from the fault. Assume

an earth leakage at *E* on a 250-volt, three-wire system of distribution (Fig. 4), the current shown on the ammeter with the ten-ohm limiting resistance in circuit being ten amperes through the fault. This gives a total resistance between the fault and the earth plate of fifteen ohms, and a difference of potential of 150 volts. This pressure will be highest immediately at the fault, and will diminish with the distance from the fault. It can be measured by an ordinary voltmeter, but in most cases a special voltmeter, calibrated to read down to very small pressures, is desirable. One terminal of the voltmeter is connected to a rubbing contact and the other to a good earth connection, such as a steel rod pushed into the ground at a distance of two or three yards from the cable route. The

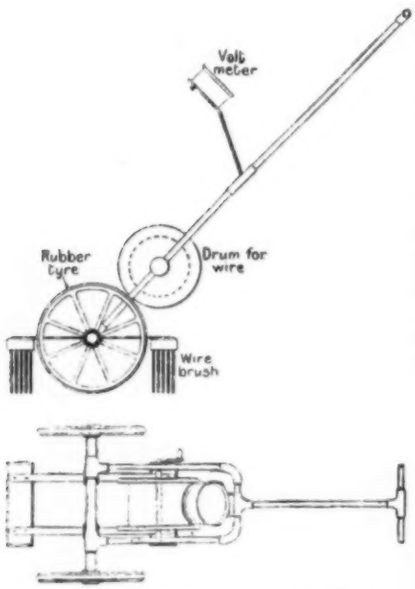


FIG. 5.—APPARATUS FOR LOCATING EARTHS.

apparatus shown in Fig. 5 has been constructed for this potential method of locating earths. A light carrier, to which two steel brushes are attached, so as to make a continuous contact with the surface of the earth, is pushed over the ground above the cable route, and the fall of potential noted on a voltmeter between the earth connection and the ground in contact with the brushes. In addition to the voltmeter the carrier is fitted with a small revolving drum, which winds or unwinds the voltmeter lead as required. To obtain more accurate measurements, a center zero-reading voltmeter with multiplier is connected between the two brushes—insulated from one another—when the exact location of the fault may be effected by moving the carrier until the voltmeter reading becomes zero. Besides simplicity in operation and accuracy of results, other advantages of this method are that the smallest earth leakages can be expeditiously located without interruption to the supply, the apparatus is cheap and simple in construction, while the test may be made by anyone possessing elementary technical skill. The method is applicable to any system of supply. In the case of a two-wire supply, it is necessary only to earth the unaffected conductor to give the required difference surrounding the fault.

In very few cases it is found impossible to locate faults by the method described by the author, and in these recourse has been had to the Wheatstone-bridge methods or to Murray's loop test; these, however, require the disconnection of the faulty section.

One of the most trying faults to locate is that of a burnt-through cable which still retains its normal insulation resistance to earth. If a leakage cannot be started by subjecting the insulation to a high-pressure test, its position may be found by an elaborate capacity test from either end, or by cutting the cable at various points along its length.

Artificial Rubber.

Special Agent Henry Studniczka writes from Birmingham, England, concerning the production of artificial rubber and its effect on the rubber industry and trade, should all that is claimed for it prove true:

There is quite a stir among the directors of leading rubber importing and manufacturing firms here regarding the reported invention of artificial rubber by a German professor at Kiel, and they seem to be very optimistic, as the inventor enjoys an unquestioned reputation as an authority on all matters pertaining to rubber. The invention is based on the boiling together, under certain conditions, of isoprene with acetic acid, in a closed tube, the result being the creation of a gray composite possessing all the properties of pure rubber and capable of being vulcanized in the same manner as gutta-percha. At present this artificial rubber has been produced only in small quantities, but it is the inventor's opinion that when his method has been fully developed it will permit of the placing on the market of an article at one-third the cost of real rubber.

Ohio Society of Mechanical, Electrical and Steam Engineers.

The twenty-first semi-annual convention of the above society was held in Cincinnati, Ohio, on May 19 and 20 last.

Among the papers presented were the following: "Selecting a Boiler," by F. C. Bitgood; "Scientific Treatment of Boiler Feed Water," by H. E. Stone; "Refrigerating Machinery and Appliances," by H. D. Pownall.

Several plants were visited, including that of the Union Gas and Electric Company and the new plant of the Triumph Electric Company, at Oakley.

Oscar F. Rabbe, Toledo, Ohio, is the president and Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio, the secretary-treasurer of the society.

Electrical Supplies Imported by Canada.

Consul Frank Deedmeyer writes from Charlottetown that the imports by Canada of electrical goods in the fiscal year 1909 amounted to $2,128,241. Nearly all of these, or $1,992,110 worth, came from the United States. This trade rose rapidly from $871,312 in 1900 to $3,578,288 in 1906; since that year there has been a steady decline. This is due to the establishment of Amerian branch factories in the Dominion. In the Province of Prince Edward Island the installation of electric lights is becoming general and there is a growing market for electric-light fixtures. Those of brass finish, medium in price, are mostly in demand. Lists of firms in Canada handling electric fixtures are on file for inspection at the Bureau of Manufactures, Washington, D. C.

Technical Publicity Association.

The thirty-seventh regular monthly dinner and meeting of the Technical Publicity Association was held on May 12 in the galleries of the National Arts Club, New York city. The subject of "House Organs" was taken as the topis for the evening's discussion.

C. R. Lippman, H. S. Snyder, H. M. Wilson, and others spoke on this subject and a number of very interesting points were brought out.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

REGULATION AND ILLUMINATION.[1]

BY L. B. SPINNEY.

Every central-station manager will admit the desirability of good voltage regulation. That its real importance is recognized even by the majority of plant operators is, on the other hand, very much open to question.

The subject is ordinarily discussed from the standpoint of station efficiency and the life of the incandescent lamp, and the arguments afforded are sufficiently convincing to make it seem unnecessary to go farther, since it can easily be demonstrated that excessive voltage tends to decrease the operating efficiency of the plant and the life of the lamp as well. The idea is held by some central-station managers that an increase of voltage always results in an increase of light. This is a mistake. It is true that for new lamps a voltage above normal will result in a temporary increase of candlepower; but it is also true that under excessive voltage the incandescent lamp rapidly falls off in candlepower and after a time will have so far deteriorated that an abnormally high voltage will be required to bring it to even normal candlepower. This is equivalent to saying that after it has been operated for a time at excessive voltage it may be operated at a voltage above normal and still give less than rated candlepower. It will thus be evident that the continual use of excessive voltage results in an actual loss of light when the operation of the lamp is considered from the standpoint of its average candlepower.

Excessive voltage also results in increased power consumption. Abnormal voltage is thus a double evil. It decreases the average candlepower and thereby gives cause for complaint on the part of the customer, and by increasing the power consumed gives further cause for dissatisfaction with the service.

The decrease of the commercial life of the lamp with increase of voltage is very marked, and is far greater than would be suspected from the percentage voltage variation alone. Tests of 3.1-watt carbon lamps have shown that an increase of voltage of only three per cent reduces the commercial life of the lamp more than one-half, while an increase of six per cent reduces the life by more than two-thirds. Table I gives the life of such a lamp at voltages ranging from 100 per cent to 106 per cent normal.

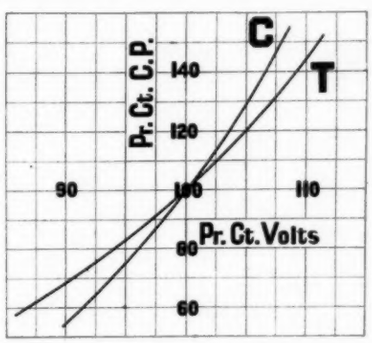


FIG. 1—VARIATION OF CANDLEPOWER WITH VOLTAGE.

TABLE I.

Percentage Normal Voltage.	Percentage Life of Lamp.
100	100.0
101	79.5
102	61.5
103	49.0
104	40.0
105	34.0
106	29.0

As above stated, it would seem that these considerations alone would be sufficient to illustrate the importance of good regulation; but there is another and even more convincing argument, viz., its affect upon illumination. It is to this consideration that attention is here directed.

The characteristic of the incandescent lamp is such that a small change in the voltage at which it is operated results in a relatively large change in its candlepower and therefore in the illumination derived from it. For example, a two-per-cent increase of voltage increases the candlepower of a carbon lamp twelve per cent, a voltage five per cent in excess of normal increases the candlepower more than thirty-one per cent. This variation of the candlepower with voltage is given more in detail in Table II.

TABLE II.

Percentage of Normal Voltage.	Percentage of Normal Candlepower.
94	69.5
96	79.
98	89.
100	100.
102	112.
104	124.5
106	138.5

This relation is again shown graphically in Fig. 1. Curve *C* gives this relation for a 3.1-watt carbon lamp. Curve *T* is for a tungsten lamp. It may be noted in passing that the change in candlepower for a given change in voltage is materially less for the tungsten than for the carbon lamp. The effect is nevertheless large even for a lamp of this type. The arguments given below may therefore be applied regardless of the kind of lamp used. Such differences as may be noted will be differences of degree and not of kind.

For the purpose of illustrating the importance of the lamp characteristic in this connection, charts have been prepared, setting forth the regulation curves of four central Iowa plants and the candlepower or illumination curves corresponding. These charts are shown in Figs. 2 to 5.

The data for the regulation curves were taken by means of a portable voltmeter. The readings for each plant were taken without the knowledge of the plant operator and at some distance from the central station. The average voltage at the given point was obtained and all variations were expressed in per cent of the average. These values when plotted give the percentage voltage regulation curve for the point at which the readings were made. The lighter curve in each figure gives this regulation.

[1] A paper read at the tenth annual convention of the Iowa Electrical Association, April 29, 1910.

The heavier curve, the illumination curve, was plotted on the assumption that the lamps in use were selected to operate normally at the average voltage, at 3.1 watts per candlepower. By means of a curve like that shown at *C*, Fig. 1, the percentage variation in candlepower for each variation in voltage was obtained and laid off opposite the corresponding point of the regulation curve. This curve shows in a striking way to what extent the voltage fluctuation is magnified in the change in candlepower of the lamps or, what amounts to the same thing, in the illumination derived from the lamps in service.

The curves shown are widely different, each having a more or less distinct character and suggesting in a definite way the predominating cause of voltage fluctuation.

For the purpose of making the analysis of these curves more direct it will be helpful to consider the several sources which may contribute to poor regulation at a distance from the plant. The first of these is of course the regulation at the switchboard. Evidently a variation in the switchboard regulation will effect the regulation at all points on the line.

The second source of variation is the line itself. If insufficient copper has been used in the construction of the line there will be excessive pressure drop on that line during its period of heavy load. This item is of more importance in direct-current systems of low voltage than in alternating-current systems; but is not to be lost sight of in any case.

The third source of variation is the transformer. In a plant making use of many small transformers, especially if they are of the older types and of low efficiency, this source of voltage variation is of great importance. When larger and more modern transformers are used the effect of transformer regulation is relatively less. It will be evident that both line loss and transformer regulation are of greater importance for points far removed from the plants than for points near by, since for direct-current systems the longer the line, other things being equal, the greater the line drop, while for alternating-current systems the transformer regulation is always to be added to the line loss in the primary, which for the longer lines may be appreciable.

Added to the effects of primary line and transformer are the effects of line drop in the secondary or low-pressure lines. Evidently primary line loss plus transformer regulation plus secondary line loss gives for the alternating system that which corresponds to simple line loss in the direct system.

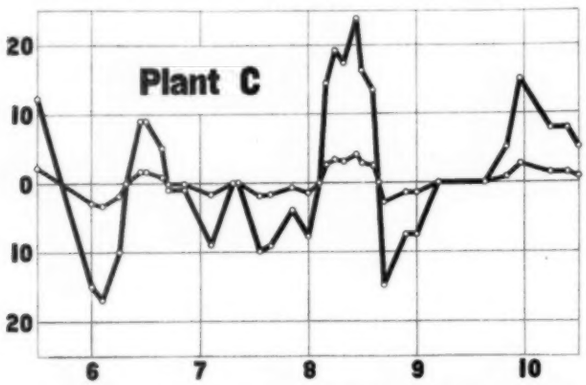


FIG. 2—REGULATION AND ILLUMINATION CURVES OF PLANT C.

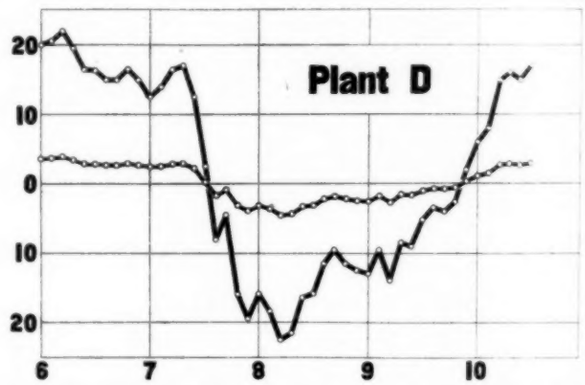


FIG. 3—REGULATION AND ILLUMINATION CURVES OF PLANT D.

Generally speaking, the effects of switchboard regulation and line loss are present together, and their effects may be cumulative. Increased voltage at the switchboard may be balanced, with increasing load, by the voltage drop on the line. On the other hand, decreased voltage under a like condition will produce even worse regulation than that due to line loss alone. In other words, the line loss tends to neutralize any excess of voltage at the switchboard and to aggravate the difficulty when the switchboard voltage falls.

Bearing these facts in mind it will be seen that the form of the regulation curve indicates which of the two principle sources of poor regulation mentioned above is predominant in the given case. The regulation curve of plant *D*, Fig. 3, for example, indicates that poor regulation is in this case almost entirely a line effect. It shows plainly that a heavy load was carried by the line from about 7.30 until 10.00 o'clock. The fact that the curve is smooth indicates that there was but little variation at the plant. Its elevation from 6.00 to 7.30 and after 10.00 o'clock indicates that the fluctuation was peculiar to this particular line, since had it been general it is reasonable to suppose that some attempt would have been made to reduce it by switchboard control.

The regulation curve from plant *F*, Fig. 4, indicates that the line effect was small, if not entirely negligible. The variations here shown are clearly those due to the efforts of the switchboard attendant to keep the station voltage constant.

The curve for plant *J*, Fig. 5, shows a combination of the effects observed in plants *D* and *F*. The gradual depression of the curve from a value well above the average at the beginning of the evening to an equally low value at about 8.45 and the subsequent rise toward the initial value, points unmistakably to a line effect. The saw-tooth character of the curve, as in the curve for plant *F*, shows that at intervals of a few minutes the switchboard voltage was "adjusted" with a view to keeping it constant. Evidently this curve would bear close resemblance to that of plant *F* had it been taken at the central station.

The evidence afforded by the regulation curve from plant *C*, Fig. 2, is perhaps not so clear. It is evident, however, that no individual line effect is here shown. At the same time the fluctuations are of such long period that they cannot be interpreted as

showing a very high degree of watchfulness on the part of the switchboard attendant. If one were to hazard an opinion as to the meaning of the long period fluctuations of this curve it might be suggested that the variations are such as would result from carelessness or lack of skill on the part of the man in the boiler room whose spasmodic or unskillful attention to duty resulted in half-hourly variations in steam pressure.

A discussion of these curves can hardly fail to call attention to the value of a voltage exploration of the net work of lines which radiate from the central station for the purpose of determining the regulation of the various lines and centers of distribution. It is undoubtedly true that many central-station managers have little real knowledge of the regulation on their various lines, and content themselves with switchboard measurements and adjustments. It is quite impossible, as indicated by the above discussion, to secure even reasonably good results by this method. The first step toward improving the regulation of a plant, is to make an exploration of the various lines with a voltmeter. The individual line effects should then be corrected by adding copper or by redistribution of line loads. When this has been done, and lamps of proper voltage have been placed on the various parts of the system, due attention to switchboard voltage will insure results. Poor regulation, as has been repeatedly pointed out, is the greatest cause of dissatisfaction among the users of electric light. Surely it is good business on the part of the central-station manager to make a systematic study of his plant from this standpoint, in order that he may remove as far as possible this barrier to successful plant operation.

The purpose of the tables and illumination curves here shown is simply to give emphasis to the argument for good regulation. And the emphasis given is certainly most convincing. A variation which expressed in volts may seem allowable is quite out of the question when given in terms of illumination. A new customer may, for example, accept as satisfactory the assurance that the line voltage will not vary more than five per cent from the normal. It is hardly reasonable to suppose that he would accept with the same complacency, the equivalent statement that his lamps would fluctuate from twelve to twenty candlepower, or that the illumination of the page as he sat before his reading lamp would vary from 1.5 to 2.5 foot-candles.

In Table III are given the maximum positive and negative variations of voltage and illumination of the plants discussed above.

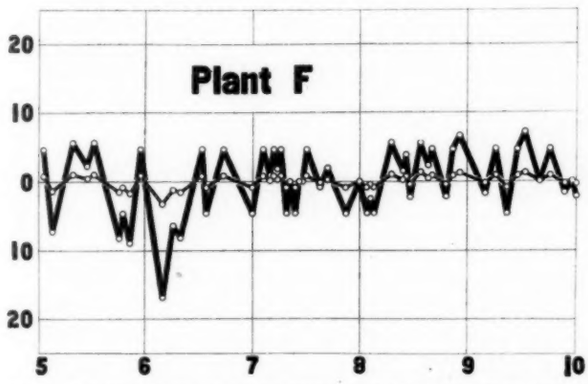


FIG. 4—REGULATION AND ILLUMINATION CURVES OF PLANT F.

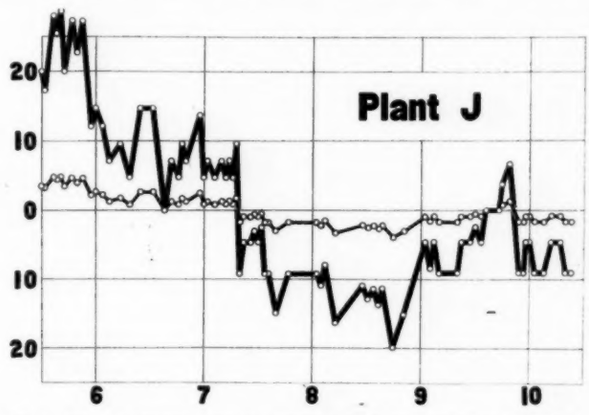


FIG. 5—REGULATION AND ILLUMINATION CURVES OF PLANT J.

TABLE III.

	—Percentage— Variation in Voltage.			—Percentage— Variation in Illumination.		
Plant.	Above average.	Below average.	Total.	Above average.	Below average.	Total.
C	4.1	3.2	7.3	23.4	16.8	40.2
D	3.9	4.5	8.4	21.6	22.3	43.9
F	1.2	3.2	4.4	7.1	16.8	23.9
J	4.7	3.8	8.5	28.3	19.9	48.2

This table shows that in plant *J*, for example, the voltage during the evening ranged from 4.7 per cent above the average value to 3.8 per cent below, a total variation of 8.5 per cent. The illumination for the same plant ranged from 28.3 per cent above to 19.9 per cent below average, a total range of more than 48 per cent. Again in plant *F*, for which the voltage range was comparatively small, the total value being 4.4 per cent, the illumination varied nearly twenty-four per cent.

It is needless to enlarge at this point upon the difference between a constant illumination and one which flickers or fluctuates. From the standpoint of efficiency as well as of comfort in use, this difference is very generally recognized and understood.

These illumination curves are especially instructive in view of the fact that illumination is the commodity which the central station virtually contracts to supply. It is tacitly understood between customer and central-station manager that the service shall afford a reasonably constant illumination. The illumination curve shows therefore to what extent the central station has supplied that quality of service for which the consumer pays.

Rensselaer Polytechnic Institute Offers Scholarship.

The Board of Trustees of Rensselaer Polytechnic Institute, Troy, N. Y., offers a scholarship to male graduates of the high schools and academies of Chicago. An examination for those desiring to compete will be held at Hurd Hall of the Northwestern University Building, 87 Lake Street, Chicago, under the direction of John C. Burg, from June 20 to 25.

Applications for examination must be obtained from the College Entrance Examination Board, Post Office Sub-station 84, New York, N. Y. These must be filled out and returned, with a fee of five dollars, so as to be received by the Board on or before June 6.

The scholarship entitles a student to free tuition for a period of four years, thus having a money value of about $800.00.

A good class of applicants is expected for the scholarships.

TELEGRAPHY—TELEPHONY, and WIRELESS.

A TELEPHONE RELAY.[1]—I.

BY S. G. BROWN.

This paper deals with the telephone relay and its various applications. The relay is the outcome of six years study, but has only been brought to its final form during the last eighteen months.

Edison, soon after his invention of the carbon-button transmitter, caused an electromagnet to act upon the iron diaphragm and thus turned it into a relay, but it was not a success. Hughes, in his paper before the Royal Society in 1878, describing his extremely delicate microphones, stated that a telephone receiver, if included in the microphone circuit and placed upon the resonant board, caused a continuous sound to be produced. It follows, he says, that the question of providing a relay for the human voice in telephony is thus solved. Unfortunately it was not solved, he had shown how to make a relay that would magnify a noise or musical note, but not one that would intensify articulate speech.

Sir Oliver Lodge, in 1898, described a relay, consisting of three or four reeds or tuning forks, each carrying carbon contacts and working in series with one another. Each reed was arranged to resonate to one particular musical note, and when this note was passed through the string of relays, it was multiplied in power to a considerable extent. An instrument of this character, however, is not effective in intensifying speech. An articulate relay must have its vibrating parts damped, or, in other words, possess no resonating properties, it is therefore far more insensitive to sound than one that is arranged to resonate to one particular note.

The invention of the powerful granular transmitters of the Hunning type stimulated further efforts to obtain the speaking relay, and some progress was made with this type of microphone, particularly in America.

The author's telephone relay has had to be developed along quite new lines. It takes as its basis the researches of J. J. Thomson, Earhart, Kinsley, and others, with regard to the flow of electrons across a microscopic air-gap between two conducting surfaces at different potentials. Earhart made a series of experiments on the difference of potential required to produce sparks whose length is comparable with the wave-length of sodium light, and he found that when the distance between

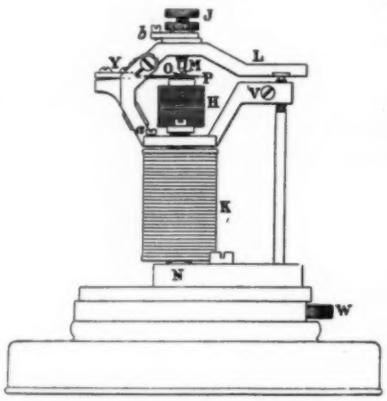


FIG. 1—SIDE VIEW OF TELEPHONE RELAY WITH COVER REMOVED.

the metal electrodes falls to less than about 3×10^4 centimetres, the spark potential falls off rapidly with the distance, and seems to become proportional to the distance; that is to say, when the electrodes are placed very close together, within a distance such that the average intensity of force F between the electrodes reaches a value of about a million volts per centimetre, the discharge or current passing is determined by the condition that F, which is V/d, reaches this value (where V is the potential difference, and d the distance between the electrodes). If the metallic circuit of a dry cell be interrupted by a minute opening or space of the order of 5×10^7 centimetres, the metal at the point of interruption being platinum, the current will continue to flow round the circuit and across the opening, and any slight alteration in the length of the space, which I shall call the conduction space, will vary its resistance and greatly affect the value of the current that flows round the circuit. The conduction space is therefore exactly what is wanted for the current-varying device of a telephone relay, where microscopic mechanical movements are to be transformed into large current changes. The dimensions of the conduction space are so small that it is difficult to insure and maintain it by direct mechanical means. The current that flows across the space was therefore made to do its own adjustment, very much in the same way as the current that passes through the arc of an arc lamp is made to strike and maintain the length of the arc.

Fig. 1 is a side view of the instrument with the brass cover removed. N is a permanent magnet, continued by soft-iron poles right up to but not touching the "invar" steel reed P. Round the soft-iron pole extensions are wound the two sets of coil windings H and K. The telephone currents to be magnified circulate round the winding H and thus by varying the magnetism set the reed P in vibration. M O are the top and bottom metal contact-pieces, which are opened to an infinitesimal degree to form a microphone by the fine adjusting screw W and by the action of the local current passing through the contact and round the winding K. It is by the action of the local current operating through this winding that the conduction space is formed and afterwards maintained. So good is the automatic adjustment that the instrument may be turned upside down, producing hardly any noticeable alteration in the value of the local current and without any effect on the working of the relay. The regulating winding K must not act when traversed by the rapidly varying telephonic cur-

1 Abstract of a paper recently presented before the Institution of Electrical Engineers, London, Eng.

rents: this is brought about by surrounding the iron under the coil by a closed-circuited copper sheathing. Eddy currents set up in this sheathing by mutual induction destroy the self-induction of the coil.

Fig. 2 is an enlarged view of the reed *P* and the contact-pieces *M O*. In the present instrument the contact is made between metal pieces of hard osmium-iridium alloy. The top contact is pointed, the lower one is flat and is soldered to the reed, both are polished and work under a small drop of thin oil.

In earlier instruments the lower contact *O* was carried by a thin iron disk, the relay was then very susceptible to outside noises. For this reason a reed is now used, it exposes such a small surface to the air that it is practically unaffected by extraneous sound.

Fig. 3 shows the connections of the

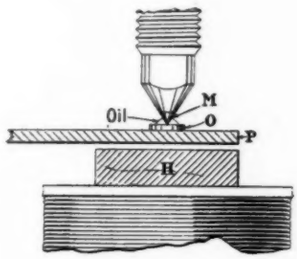


FIG. 2—DETAIL VIEW SHOWING REED AND CONTACT-PIECES.

relay. *C* is a dry cell (this is the normal voltage, which is as high as it is desirable to employ), *K* the low-resistance regulating winding, *T* the receiving telephone or telephone headpiece of approximately forty ohms resistance, *D* is an amperemeter or current indicator. When the microphone contact is opened so as to cut down the local current to half its maximum value the relay is usually at its best adjustment. The telephone currents to be magnified enter by the terminals marked *A* and circulate through the winding *H*.

The relay will magnify the very feeblest telephone currents. Speech or signals that are too faint to be heard in the ordinary Bell receiver may be heard clearly through the relay. If a watch be held against the earpiece of a Bell telephone the induced currents produced when passed through the instrument will reproduce the ticking in the receiver attached; this is a severe test.

This property of magnifying feeble telephone currents has made it particularly useful in wireless telegraphy. On replacing the telephone by the relay the increased sensitiveness thus obtained doubles the distance over which it is possible to receive signals. Its utility in this direction has been tested among others by the British Admiralty and the Post Office. In a wireless receiving station, messages, the very existence of which was not even suspected, owing to their extreme feebleness, when listened for under former conditions with the relay in circuit, were easily read. At the invitation of Mr. Marconi I took two instruments to the Haven Hotel, Poole. In one of the tests (Clifden, in Ireland, sending with the Marconi musical spark) the signals were heard in the telephone, directly connected, as a faint but clear and pleasing series of musical notes. But with two relays joined to the system and working in series the notes were rendered so loudly as to be heard clearly by every one in the room, and an operator listening at a distance of several yards from the instrument could have deciphered the message. The relay is not easily affected by extraneous noises and vibration. It can thus be carried on board ship and worked in all weathers.

As regards its utility on ordinary telephone lines, speech may be magnified many times in loudness without perceptible loss in the articulation, and it will work with large currents to a point at which the Bell receiver in its local circuit is responding with uncomfortable loudness. In experimenting over a twenty-pound standard cable and speaking only one way, it has been proved that, when the relay is applied, thirty miles may be added to any length through which it is possible now to speak direct. For instance, supposing the length of the core for direct speaking be twenty miles, this may be increased to fifty miles for the same loudness and approximate clearness when the relay is in circuit, either as a single repeater at the end of the first twenty miles, or as a receiver at the end of the fifty miles.

These tests prove that the telephone currents must be increased in strength to the extent of something like twenty times. If still greater magnifications are required than can be obtained with one relay, the simplest method would seem to be to employ two relays working in tandem. Their combined power would then be 400 times. In the majority of cases it is not necessary to add to the natural electrical damping of the reed, but if a piece of soft rubber be made to touch it, the voice can be transmitted with greater clearness even than if the conversation were taking place ordinarily in a room. This may be due to the complete absence of echoes.

By means of the local regulating winding (see Fig. 2), the metal contact *M O* is transformed into the most exquisitely delicate microphone, more sensitive, there is every reason to believe, than could be formed by light pressure between carbons. Such a microphone has rendered possible the construction of an electric stethoscope, an instrument by the use of which the sound of

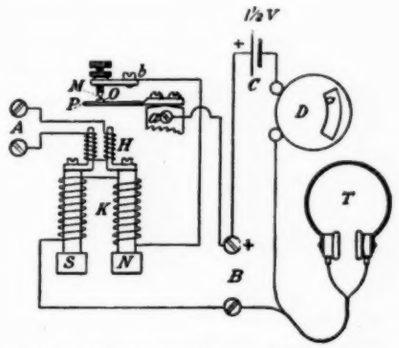


FIG. 3—CONNECTIONS OF THE RELAY.

the heart or other internal organs may be greatly magnified. This, I have been informed, may render it possible to detect in the earlier stages, heart disease, aneurism, and gall stones.

Fig. 4 is a diagrammatic illustration of the stethoscope. *A* is the front part and consists of a shallow brass cell faced by a thin ebonite diaphragm. *A* is placed upon the part of the body to be examined, say the heart; the beating of the heart is communicated to the ebonite diaphragm, then to the air inside the tube *B*, and thus the metal diaphragm *D* is set in vibration. *M O*, as before, are the osmium-iridium contact-pieces. *M* is mounted on the diaphragm, and *O* on the steel reed *P*. The magnet *N S* and the reed are carried by a brass frame *E*, which is pivoted or hinged at the lower support *Y*. The conduction space is formed between the contacts *M O* by turning the fine adjusting screw *W*, and by the automatic action of the local current from the cell *C* flowing through the winding

K and round the magnet. *T* is a special telephone transformer of equal windings of, say, twenty ohms resistance in the primary and in the secondary.

The electric stethoscope in its present form causes the sound of the heart to be three times as loud as in the ordinary stethoscope. This is scarcely sufficient for practical purposes. But if a telephone relay, such as I have previously described, be attached to the wires *x* of the transformer, the two instruments combined raise the intensity of the sound some twenty times and more, and this is ample for all ordinary purposes. The sound to be examined is picked up by the end of the tube *A*, and is heard in the telephones of a headpiece attached to the relay.

At the invitation of two physicians I took the complete instrument, stethoscope and relay, to the London Hospital, where it was tested upon a number of diseased heart cases. Not being a doctor myself, I cannot discuss the merits of the instrument with regard to its medical value, except to say that it seemed to render diagnosis particularly easy and revealed some phenomena only previously suspected. From a sound-magnifying point of view the general results were as follows: When the instrument was applied directly to the heart the sound of the beats given out in the telephones was uncomfortably loud, and easily heard by the patient and all those that stood round, and this even if the telephones were in position on the head of the operator. The stethoscope as used increased the heartbeats to the almost complete exclusion of the shriller or breathing sounds. This has been brought about by mechanically tuning the disk *D* and the reed *P* of the telephone relay to the corresponding low note, and by a proper proportioning of the volume of air inclosed by the tube *B*. On other occasions, during private experiments, the instrument has been tuned so that nothing but the breathing sounds were audible, the passage of air through the lungs was heard as the roar of the wind through a forest of trees. This power of discrimination should be of service in allowing the independent examination of various organs of the body.

Replacing the telephone headpiece by a transformer, the stethoscope has been joined to the telephone service in my house, and for the sake of experiment, the sound of the heart has been transmitted over several miles of telephone line to doctors in various parts of London and to other friends who were interested. All of them reported that the sounds received in the telephone were as loud and clear as when heard locally. The line, therefore, does not appear to produce much loss or distortion. This trial proved that it is now possible for a specialist, say, in London, to examine a patient, say, in the country, stethoscopically, and to arrive at a correct diagnosis.

The instrument must of necessity, to replace the ordinary stethoscope, be more sensitive to sound than the human ear. This is proved by slight noises made in the room being heard in the telephones as loud noises. In consequence of this, the apparatus is padded and guarded as far as is possible from all outside disturbances, and the patient should be examined in a quiet room. If the instrument is provided with a small funnel in place of the tube *B*, it will pick up and magnify the slightest sound, and ordinary speaking may be increased to a deafening shout in the telephone. Such an instrument, when properly constructed for the purpose, may be of use to those who are afflicted with deafness.

The relay has been used on the electrophone system, and by its aid, damping the reed with a piece of rubber, the speaking and music from the theatres are rendered with loudness and greater clearness than it is possible to have on the telephones supplied by the company, and by adding a loud speaker with trumpet the sounds can be heard in the room.

I come now to a subject that is interesting me greatly—it is still a matter of experiment—the production of a clear and loud-speaking transmitter. Such an instrument would give considerable comfort to the subscriber, and might save hundreds of thousands of pounds worth of copper for the companies. I am under the impression that the carbon transmitter has been developed to its full extent, ceaseless efforts having been directed to this end by the foremost telephone engineers.

To make progress towards an ideal transmitter, carbon had therefore to be abandoned, not because of any serious defect in its microphonic qualities, which are good, but because of its bad conducting power. It would not transmit enough energy. One must pass much current in order to speak loudly, and a material was wanted that not only would conduct well, but would change its resistance to pressure more readily than carbon. I am pleased to say that I have discovered something that carries out my wishes well in both of these directions.

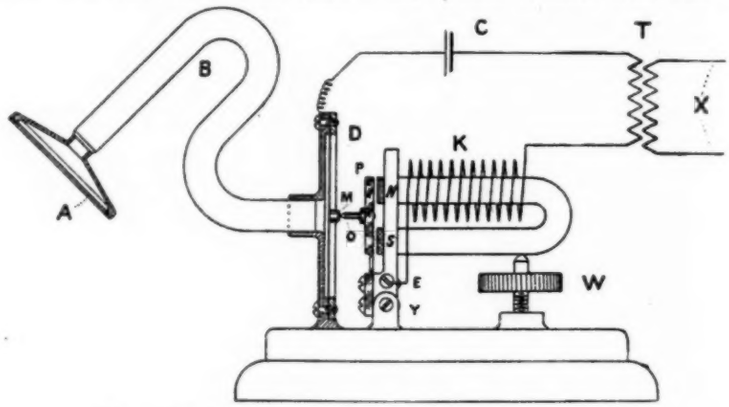


FIG. 4—DIAGRAMMATIC ILLUSTRATION OF STETHOSCOPE.

(To be continued.)

Telephone Office Discipline.

The June number of the *Operating Bulletin*, published by the Chicago Telephone Company contains an interesting letter which was written by A. S. Hibbard, general manager of the company to the superintendent of traffic, H. N. Foster.

Mr. Hibbard, in his letter, called attention to the concentration with which the operators worked; a point that he noticed while showing some visitors through the offices. On this occasion the presence of the party was not noticed by a single operator. He particularly congratulated the executive forces and the operators themselves on this discipline.

A TYPICAL RATE PROBLEM IN SMALL TELEPHONE PROPERTIES.—I.

BY FRANK F. FOWLE.

The rate problem in the telephone field has several aspects which are not common to other public utilities. There is no parallel in the other fields to the peculiar development of the telephone business from a commercial standpoint. The history of this development is most interesting and worthy of careful study, for it concerns the present situation of the rate problem in many instances. In the early days of the art the Bell companies enjoyed a monopoly under their patents; development advanced slowly and rates were correspondingly high. As the years passed and the telephone grew into larger use, there was considerable public reaction against the rates of the Bell operating companies, particularly in the middle West. This reaction of public feeling crystallized into the well-known "Independent" movement as soon as the Bell patents expired and the field opened for competition. In many communities there was a strong sentiment against foreign capital in local utilities, and in consequence there sprang up a large number of small independent companies, developed with local capital and managed by local men.

The telephone business attracted at that time many men who had had no previous experience in it, or in any other form of public-utility service. The underlying motive in the promotion of these "independent" companies was a belief that good service could be furnished profitably at lower rates than the Bell companies were then charging. In some instances this was true, but as happened with many waves of pubic opinion, the pendulum swung too far. There was a notable lack of scientific methods and engineering study during the inception of this movement. As might be predicted, the rates in a great many instances were too low for permanent success; in particular there was a wide disregard of the laws of plant depreciation, and no provision made out of earnings to meet the inevitable day when plants must be reconstructed.

On the other hand the low rates stimulated development in a marvelous way, and in the short period of fifteen years the "Independent" movement has produced a development substantially equal to that of the Bell companies. At the period when this movement started there was little application of the scientific methods now prevalent in studying rate questions, in the telephone field or in any form of public service. Without the application of such methods it cannot be apparent for a considerable period of years whether the business will be permanently successful. The "Independent" companies have fared remarkably well considering the circumstances under which many of them started. Some of them, by reason of economical and intelligent management, have been very successful and will probably continue so. But others have not done as well, financially, and it is with the conditions that are typical in some of these that this artiele is particularly concerned.

For a plant of the type that was built fifteen years ago in small towns and rural districts, comprised of open-wire distribution and small exchanges of the magneto type, the reconstruction period has now substantially arrived, if indeed it has not passed. This point is a crucial test of a company's financial condition and management, and of the adequacy of its rates, because there must be in the treasury the necessary funds to finance the reconstruction. The number of "Independent" plants in small towns and country districts comprises a large majority of the total number of "Independent" systems. Some statistics recently compiled and published from independent sources[1] are here of interest, and are given in Table I.

TABLE I.

Classification—	Number.	Per cent.
A. Over 2,500 subscribers	151	0.9
B. 1,000 to 2,500 subscribers	328	2.0
C. 50 to 1,000 subscribers	805	4.9
D. 100 to 500 subscribers	4,769	28.9
E. Less than 100 subscribers	10,434	63.3
Total	16,487	100.0

CLASSIFICATION OF INDEPENDENT TELEPHONE COMPANIES IN THE UNITED STATES.

Table I shows that the small companies greatly predominate in numbers. These statistics may be used to estimate the number of telephones in each class. The "Class A" companies will probaby average about 4,000 telephones each, or a total of 604,000; the "Class B" companies average 1,750 each, or a total of 574,000; the "Class C" companies average 750 each, or a total of 604,000; the "Class D" companies average 300 each, or a total of 1,431,000; and the "Class E" companies average fifty each, or a total of 522,000. The summary appears in Table II.

TABLE II.

	Number.	Per cent.
Telephones in Class A companies	604,000	16.2
Telephones in Class B companies	574,000	15.3
Telephones in Class C companies	604,000	16.2
Telephones in Class D companies	1,431,000	38.3
Telephones in Class E companies	522,000	14.0
Total	3,735,000	100.0

ESTIMATED CLASSIFICATION OF INDEPENDENT TELEPHONES IN THE UNITED STATES.

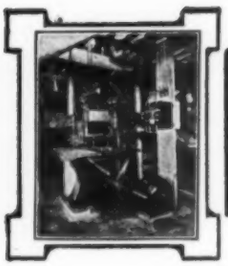
The average number of telephones per company is 227, estimated. The "Class D" companies comprise the largest proportion of the whole development, or 38.3 per cent. A company which operates about 500 telephones is therefore representative and typical of the "Independent" field as a whole. Furthermore, it is companies of this general size which probably stand in greater need of rate revision on a scientific basis than the larger ones. Companies in the A and B classes are not necessarily immune in this respect, but as a whole they are in a better financial condition to investigate this problem for themselves.

Before leaving this matter of "Independent" development, it should be noted that the statistics presented above include those companies which have traffic agreements with Bell companies and have been known by the term, "sublicensees." Companies of this class have been claimed in the total development statistics, of both "Independent" and Bell interests.

Turning now to the rate problem, it should be kept always clearly in mind that rates should be founded upon local conditions, in each case. There can be no universal solution of rate problems for all time, because conditions differ at various times in different localities, and again because the conditions in any locality are seldom stationary. The rate problem will always be with us, generally speaking. Of course, conditions seldom change so rapidly that a regulation of rates at some given time will not be equitable for a succeeding period of several years. Five years is sometimes regarded as a proper interval, and such a period has been stipulated in some of the later franchises granted to public-utility companies.

(To be continued.)

[1] *Telephony*, March 12, 1910.



Industrial Power

MODERN ELECTRIC TIME SERVICE.[1]—II.

BY F. HOPE-JONES.

In 1903 the Magneta Company was good enough to send me a report of a most exhaustive series of laboratory tests imitating extraneous induction interferences—a fine example of that German thoroughness which deserves to succeed—and I quote from a translation of it as follows: "As compared with Wheatstone's, the inductor possesses a high degree of efficiency, the magnetic field being completely inclosed in iron. It works at a much higher speed, and a space available for the motion of the aramture is unlimited. The duration of the impulses varies from 0.1 to 0.2 of a second, according to self-induction, etc."

When one has to take hold of small amounts of mechanical energy, isolated in point of time, and convert them into electrical energy, one is bound to lose most of it. Wheatstone dealt with a very small quantity every second, whereas Fischer deals with a much larger amount every minute, and consequently the loss is greatly reduced though still considerable. The limitations of such a system are obvious, and a master clock capable of operating a large circuit of small dials, or even a small circuit of large dials, must be both costly and cumbersome compared with one which has only to operate a switch. If a given dial requires five feet-pounds of energy per week to operate it, then (assuming an efficiency of 100 per cent) fifty dials will require 250 feet-pounds to be stored in the master clock weekly, in addition to its own going power; but, as we have said, in the conversion of small mechanical energy into electricty and its reconversion into feet-pounds and efficiency of, say, twenty-five per cent is the most we can hope to get, and consequently 1,000 feet-pounds will be required per week for fifty dials. In practice daily winding is usually resorted to, and though this reduces the necessary power storage to one-seventh, the size and cost of the master clock is still a difficulty in the case of large circuits, whilst the capacity of each master clock is limited, and if a time circuit requires to be extended it presumably would have to be changed.

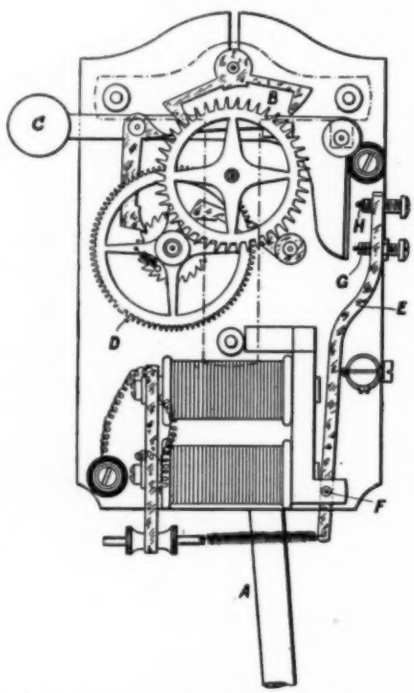


FIG. 5—"SYNCHRONOME" SWITCH.

The timekeeping of the Magneta master clock is well within its requirements because it is so constantly under the eye of the clock-winder. The accurate measurement of time for long periods by automatic means is a difficult yet alluring scientific problem with which they can have nothing to do unless and until they make their master clock self-winding. This has been suggested by means of a rotary motor in a method which will be described later on in connection with turret clocks; but can such a proposal be taken seriously? The motor would first convert current from the mains into foot-pounds in raising the weights of the master clock. In falling a little way every minute, the energy is reconverted into electricity for transmission to the dials, where it is once more converted into mechanical energy to move the hands. This roundabout method, with the heavy loss of efficiency involved in each stage of piecemeal conversion, would be necessary to enable the system to accomplish the same automatic results achieved by the modern battery system, which takes electrical energy from any convenient source, converting it into mechanical power in one simple operation wherever required. The justification claimed for the induction method is that the dials are in a permanently closed circuit, no contact being required to chop up an outside source of electricity into impulses.

The motto, "No contact and no battery," inscribed upon the Magneta Company's banner, was most appropriate in every Continental country and in America, and secured an easy victory over the old-fashioned battery-driven systems, but I hope to demonstrate conclusively that both difficulties were overcome here years ago. It seems to me that the greatest virtue of the Magneta system is one which I have never heard them claim—the uniform wave-shape of their impulses—while its greatest drawbacks are the necessity of frequent winding, the loss in conversion and reconversion, and the consequent limitation of available power.

It was precisely from this point of view—faulty contacts and failing batteries—that the author of this paper approached the subject fifteen years ago, recognizing it then as the main cause of the backward state of the science at that time compared with telegraphy, telephony, light, power, and other achievements of the nineteenth century.

1 Abstract of a paper recently presented before the Institution of Electrical Engineers, London, Eng.

The clockmaker who knew little of electricity put a pin on one of his gently moving wheels to engage a light spring, and made a poor contact, while the electrician, knowing little of horology, did the same with a stiffer spring, and stopped the clock or spoilt its timekeeping properties. That sort of thing had been going on for fifty years, and had ruined the reputation of electric clocks in this country, while abroad it drove Paris to a pneumatic system and produced complicated methods in Germany and Switzerland in which the current was reversed at each impulse.

Contacts operated mechanically by clockwork have the following vices: (1)

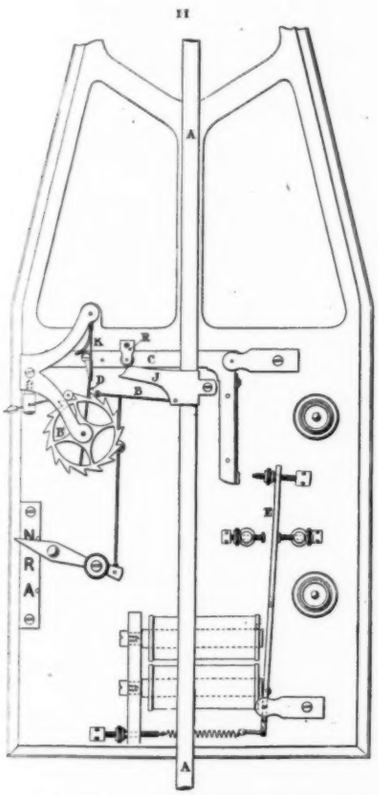


FIG. 6—LATEST FORM OF "SYNCHRONOME" MECHANISM.

What small power is available for making them is robbed from the escapement. (2) They lack precision in the make and break. (3) Their duration is arbitrarily adjusted to their supposed requirements. (4) They pass what current is available regardless of its sufficiency or insufficiency.

In my Institution paper of ten years ago I described a simple mechanism called the "Synchronome" switch, which—(1) Had ample power, but took none of it from the pendulum or the escapement which drove it; (2) was perfectly clean and precise in the make and break; (3) gave impulses whose duration was largely dependent upon the self-induction of the electromagnets they had to energize; (4) transmitted sufficient current to operate the dials, or else ceased work altogether.

The illustration from the *Journal* of that date is here reproduced as Fig. 5. The gravity lever *C* drives the wheel *D*, escapement *B*, and pendulum *A* in the usual way. When it reaches the contact screw *G* in the armature *E* the electromagnet replaces the gravity lever on the next tooth of the ratchet.

In 1904, following Campiche, Palmer, and Lowne, the escapement was dispensed with and the gravity lever was left normally on a catch, withdrawn every half-minute by an otherwise idle count-wheel propelled by the pendulum. In its latest form it is illustrated in Fig. 6, in which the gravity lever *C* normally rests on catch *K*. Once every half-minute the lever *C* is let down (in the act of giving an impulse to the pendulum *A*) upon the contact screw in the armature *E*. Current from any available source then passes through the series circuit of dials and the magnet which attracts the armature *E* and throws the lever up on to its catch again.

The pendulum releases the switch by means of the fifteen-toothed wheel B^1, which carries a vane *D* engaging with the catch *K* at each revolution. The hook *B* pivoted upon the pendulum *A* turns this wheel once every thirty seconds. At the moment of its release the little roller *R* on the gravity arm *C* is just above the curved end of the pallet *J*, down which it runs, giving an impulse to the pendulum at the moment when it passes through its zero or central position. Thus the pendulum is free at all times except in the middle of its swing. The setting lever serves to stop the dials when moved from *N* (normal) to *R* (retard), or to accelerate them when moved to *A*. The method of impelling the pendulum as it passes through its zero position by the falling lever is well known in horology as the invention of Sir H. H. S. Cunynghame, being an adaptation of his detached gravity escapement with free pendulum made as a mechanical clock in 1904.

In addition to the merits of the switch in its old form its two parts have a longer range of movement and sail into contact at the speed of the moving pendulum; when the current falls below a certain predetermined value the pendulum assists the magnet to replace the lever *C*, which action is a valuable indication of impending failure of battery, and if the pendulum stops it holds the switch open.

The dial movements illustrated in Fig. 7 are of the simple reciprocating armature type designed to deal with clock hands of considerable inertia and momentum, and made in five different sizes for clocks ranging from three inches to ten feet diameter. The wheel *A* has 120 rectangular teeth and carries the minute hand on its axle. The magnet *B* attracts the armature *C* mounted on lever *D*, by which means the click *E* picks up a tooth and the wheel is propelled by spring *F*. The backstop lever *G* and stops *H* and *I* are so arranged that the wheel is locked at every point

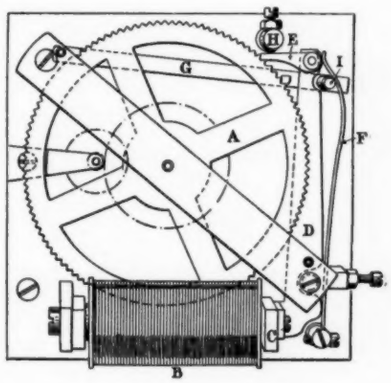


FIG. 7—DIAL MOVEMENTS.

in the cycle of operations, yet can be free at once by raising the lever *G*.

(To be continued.)

To Reduce Cable Rates.

Cable rates from New York and points east of the Rocky Mountains and Canada to Peru, Bolivia, Chili, the Argentine Republic, Uruguay and Paraguay, were reduced from $1 to eighty-five cents a word on June 1. The reduction was brought about through the laying of a new cable from Buenos Ayres to Ascension Island by the Western Telegraph Company.

The Central and South American Telegraph Company has announced a reduction in rates to meet the charges by the Western Telegraph Company. From points west of the Rocky Mountains the rate will be eighty-six cents a word.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE ENOS COMPANY, of New York, has been awarded the contract for installing lighting fixtures in the library building at New Bedford, Mass. The contract price was $7,250.

THE EDWIN C. BENNETT & COMPANY, Omaha, Neb., are installing the line work and wiring in the town of Delmont, S. D. Wiring is progressing rapidly under the direction of Wm. W. Berger. The town is to be lit exclusively by tungsten or tantalum lamps.

THE ELECTRICAL SUPPLY HOUSE, Gridley, Cal., has recently been started in business by J. A. Deruchie and R. A. Beebee. The new concern will do all kinds of electrical wiring and furnish all sorts of electrical supplies. The demand for electrical apparatus is on the increase and the new firm will keep abreast of the times, carrying a full stock.

THE CAPITAL ELECTRIC COMPANY, Salt Lake City, Utah, has secured the contract for erecting the electric light plant for the town of Price. The complete plant will cost $18,000 and the contract calls for a 150-kilowatt, three-phase alternator and complete wiring of the town for light and power, including 100 tungsten street lights. The plant is to be completed by September 1.

THE CAROLINA ELECTRICAL COMPANY, 110 Fayetteville Street, Raleigh, N. C., has been awarded a contract to supply the electrical equipment for the engineering building to be erected for the North Carolina Agricultural and Mechanical College. This company does engineering and contracting work, handles supplies, and installs electric light, telephone and annunciator equipments, etc.

HERBRICK & LAWRENCE, Nashville, Tenn., have secured a number of large contracts for electrical installations around that city. One of the largest of these was the furnishing and installation of a light plant and fixtures of the Tennessee Hospital for the Insane. Other large contracts of this nature are the Tennessee Oak Flooring Company in East Nashville and the New Orpheum Theater. This concern also has the heating and plumbing contract for this building. A number of contracts for wiring residences have also been closed.

COOK, KRIES & COMPANY, 227-231 West Saratoga Street, Baltimore, Md., were awarded the contract by the Sisters of Notre Dame, to install heating and ventilating apparatus, engine and generator in power house. The entire plant is to be remodeled and improvements including a 250-horsepower water-tube boiler, and an extension of cable mains from power house to buildings in tunnels. The cost will be $25,000; Thomas C. Kennedy, 516 Law Building, Baltimore, is architect; Charles L. Reeder, 919-921 Equitable Building, Baltimore, is consulting engineer.

STORM & COMPANY, Newark, N. J., were awarded the contract for supplying and erecting the system of poles and wires for use in connection with the municipal electric plant. The bid was based on a system of units, the total estimated cost being $54,000. The contractor has 160 days from the date of approval of the award of contract by the council in which to complete the work. It is expected that the power-house will be ready by the time the poles and wires are in place, and if weather conditions are favorable the plant will be delivered by November 1. Contract for the conduit work in the underground district has already been awarded to the McKay Engineering Company.

Report on Block Signals.

Under the direction of the Interstate Commerce Commission, the Block Signal and Train Control Board has compiled and published a report regarding block signals in use on railroads of the United States on January 1, 1910. The report also includes a table showing the extent of the use of telephones in the transmission of train orders. The total length of road in the United States operated under the block system on January 1, 1910, was 65,758 miles. Of this mileage 14,237 was automatic and 51,520 was manual. During 1909 there was an increase of 2,047 miles in the length of road covered by the automatic block system and an increase of 4,162 miles in the length of road covered by the manual block system, making a total increase in the miles of road covered by the block system of 6,209 miles.

Ten roads which have not heretofore reported the use of block signals appear in this report and twenty-two roads have made notable changes in their block signal installations.

The telephone is used to a greater or less extent for the transmission of train orders on about 275 railroads; the aggregate mileage operated by these companies is 131,014 miles, and the telephone is used on 26,344 miles of road.

Navy Wireless Tests Begin.

The crusier Birmingham, which has been in Liberian waters for several weeks, has sailed for Hampton Roads via Cape Verde, after having been relieved by the Des Moines.

The vessel, which is fitted with a powerful wireless outfit, will endeavor to get in touch at the earliest moment with the new naval wireless station on Brant's Rocks, on the Massachusetts coast, to test the maximum sending capacity of the outfit. As the tower on Brant's Rock has a much more powerful transmitting apparatus than the ship, it is expected that the Birmingham will be receiving many messages that she cannot answer while on her way across the South Atlantic, but will be shown on her log when she arrives.

The Elimination of the Horse.

The elimination of the horse in cities is one of the points touched upon in "The Tomorrows of Electricity and Invention," by Thomas A. Edison in the June number of *Popular Electricity*. Mr. Edison takes the stand that higher ideals of health and cleanliness will bring about the substitution of electric or gasoline-driven vehicles for the horse-drawn wagon. In the same article he advocates automatic stores, which would bring the distributing cost of goods sold down to a minimum.

Wireless Station on Pike's Peak.

The information comes from Denver that a wireless-telegraph station is soon to be installed on the summit of Pike's Peak. Should this station be erected it will be used as the midway transmitting and receiving point in an effort to send wireless messages from the Atlantic Coast to the Pacific.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of April and four months ended April 30 compares as follows:

	1910	1909
April gross	$ 274,605	$ 238,448
Expenses	9,423	9,184
April net	265,182	229,264
Four months' gross	1,240,777	1,086,480
Expenses	36,631	35,207
Four months' net	1,204.146	1,051,273

AURORA, ELGIN AND CHICAGO.

The report of the Aurora, Elgin and Chicago Railroad Company for the month of April and ten months ended April 30, 1910, compares as follows:

	1910	1909
April gross	$ 120,384	$ 106,411
Expenses	71,150	64,182
April net	49,234	42,229
Charges and taxes	33,310	28,552
April surplus	15,924	13,677
Ten months' gross	1,302,282	1,183,401
Expenses	726,760	653,439
Ten months' net	575.522	529,961
Charges and taxes	307,266	280,245
Ten months' surplus	268,257	249,717

NIAGARA, LOCKPORT AND ONTARIO.

The report of the Niagara, Lockport and Ontario Power Company for the month of April compares as follows:

	1910	1909
April gross	$ 40,602	$ 23,061
Expenses	16,086	15,903
April net	24,516	7,157
Other income	1,463	2,776
Total income	25,979	9,933
Charges	20,833	20,833
April surplus	5,146	*10.899

*Deficit.

INTERBOROUGH RAPID TRANSIT.

The earnings of the Interborough Rapid Transit Company for the month of April and ten months ended April 30, 1910, compares as follows:

	1910	1909
Gross operating revenue	$2,564.775	$2,421,088
Operating expenses	937,047	893,202
Net operating revenue	1,627,727	1,527,886
Taxes	156,643	155,149
Income from operation	1,471,084	1,372,738
Other income	*$29,670	85,241
Total income	1,500,755	1.457.979
Interest, rentals, etc., including Manhattan guarantee	878,356	864,152
Net corporation income.	622,399	593,827
Dividends	262,500	262,500
Surplus	359,898	331.326
Passengers carried	49,878,523	47,145,189
July 1-April 30:		
Gross operating revenue	$24,094,852	$21,946,440
Operating expenses	9,148,533	8,984,329
Net operating revenue.	14,946,319	12,962,111
Taxes	1,429,488	1,500,192
Income from operation	13,516,830	11,461,918
Other income	*349,726	834,776
Total income	13,866,557	12,296,695
Interest, rent, etc., including Manhattan guarantee	8,791,071	8,653,194
Net corporation income	5,075,485	3,643,500
Dividends	2,625,000	2,625,000
Surplus	2,450,485	1,018,500
Passengers carried	467,848,217	425,680,112

*The decrease in non-operating income is largely due to the policy inaugurated July 1, 1909, of not crediting to the income of the company the interest upon the advances made for the construction of the New York & Long Island Railroad Tunnel.

KINGS COUNTY ELECTRIC LIGHT AND POWER.

The report of the Kings County Electric Light and Power Company for the month of April and four months ended April 30, compares as follows:

	1910	1909
April gross	$ 342,413	$ 295,428
Expenses	163,260	144,530
April net	179,153	150,897
Charges, depreciation, etc.	103,602	84,716
April surplus	75,551	66,181
Four months' gross	1,414,053	1,238,345
Expenses	655,020	578,466
Four months' net	759,033	659,878
Charges, depreciation, etc.	406,252	349,693
Fourth months' surplus	352,781	310,185

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electris Railway Company for the month of April and four months ended April 30, 1910, compares as follows:

	1910	1909
April gross	$ 86,915	$ 78,574
Expenses and taxes	48,513	45,651
April net	38,402	32,923
Charges	34,902	34,353
April surplus	3,500	*1,430
Four months' gross	322,770	289,316
Expenses and taxes	193,470	182,481
Fourth months' net	129.300	106,835
Charges	138,823	137,589
Four months deficit	9,523	30,754

*Deficit.

COLORADO TELEPHONE COMPANY.

The Colorado Telephone Company reports for the year ended December 31, 1909, compared as follows:

	1909	1908
Gross earnings	$2,907,726	$2,709,701
Operating expenses	2,226,466	1,866,682
Net earnings	*681,260	843,019
Dividends	595,000	592,769
Surplus	86,260	250,250
*Equal to 8.01 per cent earned on capital stock, as compared with 9.91 per cent earned on same stock last year.		$8,500,000

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company, of Philadelphia, for the month of April and ten months ended April 30, 1910, compares as follows:

	1910	1909
April gross	$ 95,690	$ 91,046
Expenses and taxes	46,152	45,317
April net	49,538	45,729
Ten months gross	931,352	888,684
Expenses and taxes	466,980	441,301
Ten months net	464,372	447,383

LONDON UNDERGROUND.

The Associated Companies of the Underground Railways Company of London report for the month of March compares as follows:

	1910	1909
Metropolitan District Railway:		
Gross receipts	£57,744	£51,557
Working expenses	27,412	28,203
Net receipts	£30,332	£23,354
Baker Street & Waterloo Railway:		
Gross receipts	£16,096	£16,440
Working expenses	7,254	7,530
Net receipts	£8,842	£8,910
Great Northern, Piccadilly & Brompton Railway:		
Gross receipts	£28,122	£27,249
Working expenses	14,204	14,494
Net receipts	£13,918	£13,155
Charing Cross, Euston & Hampstead Railway:		
Gross receipts	£17,796	£17,551
Working expenses	10,524	10,324
Net receipts	£7,272	£7,227
London United Tramways, Limited:		
Gross receipts	£28,298	£21,534
Working expenses	21,691	17,866
Net receipts	£6,607	£3,668
Total all companies:		
Gross receipts	£148,056	£134,731
Working expenses	81,085	78,471
Net receipts	£66,971	£56,314

ONTARIO POWER OF NIAGARA.

The report of the Ontario Power Company, of Niagara Falls, for the month of April compares as follows:

	1910	1909
April gross	$56,553	$11,673
Expenses	12,089	32,356
April net	44,463	*20,683
Other income	1,895	613
Total income	46,359	*20,069
Charges	42,602	26,253
Surplus	3,756	*46,322

*Deficit.

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of April and seven months ended April 30, 1910, compares as follows:

	1910	1909
April gross	$ 344,765	$ 294,374
Operating expenses	190,842	170,551
April net	153,923	123,822
Charges and taxes	49,136	40,623
April surplus	104,787	83,199
Seven months' gross	2,337,001	2,107,716
Operating expenses	1,407,826	1,320,135
Seven months' net	929,175	787,581
Charges and taxes	264,114	238,666
Seven months' surplus	665,060	548,915

DETROIT UNITED.

The report of the Detroit United Railway Company for the month of April and four months ended April 30, 1910, compares as follows:

	1910	1909
April gross	$ 724,811	$ 608,025
Expenses	486,897	374,203
April net	237,914	233,822
Other income	12.797	11,680
Total income	250,711	245,502
Charges and taxes	161,489	154,155
April surplus	89.222	91,347
Fourth months' gross	2,711,214	2,276,066
Expenses	1,781,487	1,438,353
Four months' net	935,727	837,713
Other income	49,435	46,236
Total income	985.162	883,949
Charges and taxes	641,159	614,404
Four months' surplus	344,003	269,545

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction and Light Company for the month of April and four months ended April 30, 1910, compares as follows:

	1910	1909
April gross	$ 173,763	$ 151,906
Expenses	103,683	89,586
April	70,080	62,320
Charges	43,292	43,779
April surplus	26,788	18,541
Four months' gross	658,339	586,989
Expenses	389,856	341,557
Four months net	268,483	245,432
Charges	173,166	175,265
Fourth months' surplus.	95,317	70,167

Metropolitan Reorganization.

A draft of a proposed decree of foreclosure and sale of the Metropolitan Street Railway property in New York City was recently presented to Judge Lacombe. He said this decree would allow those interested in the reorganization scheme to get the property covered by the two existing mortgages without even paying the $10,000,000 upset price fixed in the Guaranty Trust first mortgage decree. This could be accomplished by not bidding when the property covered by the first mortgage was put up and then bidding at the sale under the second mortgage.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A New Insulating Material.

The increasing demand for an insulating material having the insulating qualities of glass, porcelain, rubber, etc., and at the same time not requiring a complicated and costly process for its prodution, has led to the introduction of numerous new compositions which have met with more or less success.

The latest of these is "Hemit," which its sponsors believe will fulfill the most exacting requirements, being encouraged by the results already obtained in European countries.

Hemit is a composition moulded under pressure into the various forms and shapes required for all kinds of electrical insulation. While it is not brittle, Hemit is very hard and will take a high polish. It also has great tensile strength.

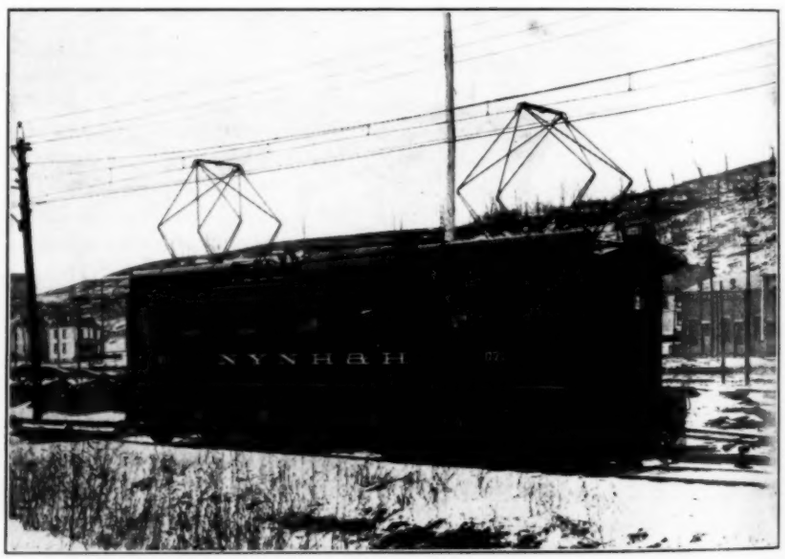
While Hemit is a first-class nonconductor and possesses very good insulating qualities, its most remarkable property is said to be that of being both fire and waterproof.

The manufacturers claim that all electrical insulators or insulated parts of electrical machines or apparatus may be advantageously made of Hemit. Among some of the more important uses the following may be mentioned: switch handles, switch bases, controller parts, field magnet spools, commutator rings, brush holders, telephone receivers, arc shields, sleeves, trolley insulators, telegraph insulators, high-tension insulators, snap-switch parts, push buttons, contact slugs, telephone mountings, etc.

A plant has just been completed for the production of this material equipped with new machinery specially designed to obtain rapidity and economy in production.

Hemit is being introduced by the Hemming Manufacturing Company, No. 2 Rector street, New York city, who are the owners of the Hemming and Gummon patents.

SEVERAL FORMS OF "HEMIT" INSULATION COMPOSITION.



VIEW OF ELECTRIC LOCOMOTIVE WHICH FULFILLED EXACTING SPECIFICATIONS.

A Jovian rejuvenation was held at Coney Island on Thursday evening, May 19. The candidates for membership were entertained at a banquet at which 162 were present. The rejuvenation followed, after which facilities were provided for a trip through "Dreamland." This was altogether the most successful meeting so far held in the metropolitan district.

Electric Locomotive Performs Well in Tests.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., completed recently the 150-ton locomotive for use on the electrical section of the New York, New Haven & Hartford Railroad, between Stamford and New York city. The entire electrical equipment, including the spring device of the motors, is the design of the Westinghouse Company, while the mechanical parts were designed by the engineers of the Baldwin Locomotive Works and the New Haven Railroad Company.

The specifications required that the locomotive be able to haul a 1,500-ton freight train at a speed of thirty-five miles an hour on level track, where the train resistance is not over six pounds per ton. They also required that the locomotive be capable of hauling an 800-ton passenger train at a speed of forty-five miles an hour. This capacity would enable it to haul an 800-ton limited train from the Grand Central Station, New York city, to New Haven, a distance of seventy-three miles, with no intermediate stops, in one hour and fifty-five minutes; or to haul an 800-ton

express train the same distance in two hours and twelve minutes, with an allowance of five minutes for stops; or to haul a 350-ton local train in two hours and forty-five minutes, with an average stop of forty-five minutes.

That the locomotive is an unqualified success has been demonstrated by frequent tests made under severe operating conditions. Besides proving itself in other ways, it has hauled thirty-seven loaded cars, a heavy freight engine, and a caboose from New Rochelle to Stamford, a distance of eighteen miles, in twenty-seven minutes. Although this run was made in a drizzling rain, that froze as fast as it fell, and made the tracks very slippery, the engine attained a speed of forty-nine miles an hour. During some tests made at the works of the Westinghouse Company at East Pittsburg, Pa., the locomotive started and accelerated a 2,100-ton freight train, both on level track and on an up-grade of 0.3 per cent on a three-degree curve. A train corresponding to the 800-ton passenger train was accelerated at a rate of about 0.4 miles per hour per second and quickly reached the required speed. For hauling trains the new locomotive has about twice the capacity of any one of the locomotives already in use on the New Haven Railroad. Each motor has a one-hour rating of about 375 horsepower and a continuous rating of approximately 310 horsepower. The tests made have shown that the locomotive has a good margin over the specifications. By its performances it has shown conclusively that it can amply fulfill the service conditions.

The design of the trucks and running gear of the locomotive is unique. The truck frames are connected by an intermediate draw-bar. One truck has only a rotative motion about its center-pin, while the other has a fore-and-aft, as well as a rotative motion, in order to compensate for the angular positions of the trucks and drawbar when the locomotive is traversing a curve. The tractive force is transmitted through the truck frames and drawbar instead of through the main frame. Each truck has two pairs of driving wheels, and a single pair of leading wheels. The wheel loads are equalized as in steam locomotive practice. To assist in reducing shocks and keeping the two trucks in alinement, chafing castings and spring buffers are interposed between the truck frames, under the center of the locomotive. The weight of the cab, instead of being carried on the center pin, is carried on friction plates at the ends of the truck. The weight is applied through springs, which have a considerable latitude for motion to allow for variation in the track without changing materially the distribution of weight on the ends of the truck. The plan of running-gear and cab support adopted for the locomotive prevents any periodic vibration or "nosing," minimizes shocks on the truck and road bed, and insures easy riding. As the rigid wheel base is only seven feet for each truck, the locomotive is extremely flexible, and easy on the track at curves and special work.

The electrical equipment, which was built and mounted by the Westinghouse Electric and Manufacturing Company, comprises four single-phase geared motors, together with the auxiliary apparatus necessary for their operation from the 11,000-volt, alternating-current or 600-volt, direct-current circuits of the electrified sections of the New Haven and the New York Central Railroads respectively. The motors are of the same general electrical design as those in use on the present New Haven locomotives, the main differences being in the mechanical details and general arrangement.

Each motor is rigidly mounted on the truck frame and directly above a quill surrounding the driving axle, to which it is geared. The motors project into the cab, and the floor above them is raised. This method of mounting the motors on the truck frame gives a high center of gravity, and prevents the transmission of strains and shocks from the track and road bed to the motors.

An air blast transformer is provided for lowering the trolley-line voltage to that required by the motors. The control apparatus is of the Westinghouse electropneumatic type.

When operating on alternating current, all four motors are connected in multiple, and the control is obtained by changing the connections to various voltage taps on the main transformer. On direct current the motors are first grouped all in series, and then two in series and two in parallel, in combination with various resistance steps. Provision is made for cutting out any one of the four motors singly on either alternating current or direct current. A master controller and brake valve are located in each end of the cab so that the locomotives can be operated from either end.

Walpole Rubber Company.

An event of considerable import to the financial world was the recent consolidation of a number of successful concerns into the Walpole Rubber Company. This company has a most surprisingly broad charter and now comprises the business and assets of the following concerns: the Massachusetts Chemical Company, doing a successful business since 1891, the Walpole Varnish Works, the Walpole Shoe Supply Works, all of Walpole, Mass.; the Valveless Innertube Company, New York City, and the Walpole Rubber Company, Granby, Quebec.

The company has a capital stock of $3,000,000 divided into $1,500,000 preferred seven per cent accumulative stock, and $1,500,000 common, par value $100 per share. At the present time the company has $450,000 of its preferred stock outstanding, but an issue of $500,000, which has recently been underwritten, will soon be placed in the market.

The Walpole Rubber Company is one of the largest makers of friction and rubber tapes in the world, and averages over 10,000 pounds daily production at its Walpole plant. The company is in the hands of practically the same men who have had charge of the Massachusetts Chemical Company and have so successfully developed its business. There is every reason for believing that they will have the same success to a greater extent with the Walpole Company. Upon the directorate appear such names as E. P. Metcalf, president of the Atlantic National Bank of Providence, R. I.; George Otis Draper, well known and successful in the machinery world of New York City; E. W. Tinkham, treasurer of the William Tinkham Company, of Harrisville, R. I., and vice-president of the Atlantic National Bank, Providence, R. I.; James Dowdle, of the firm of Mollison & Dowdle of Oswego, N. Y.; S. H. C. Miner, vice-president of the Eastern Townships Bank of Canada, and A. T. Baldwin, of Boston, who is treasurer of this company and was formerly treasurer of the Massachusetts Chemical Company.

Deflectoliers.

The advent of the tungsten lamp has led to its almost universal adoption for interior lighting. It has also caused a more serious view to be taken of illuminating engineering problems, which consideration has led to the manufacture of various fixtures and devices designed to give a maximum efficiency and at the same time be artistic in appearance.

In this connection, attention is called to the fixture shown in the accompanying illustration, known as the "Deflectolier." This fixture is designed for tungsten or similar high-candlepower lamps, particularly of the type having a plurality of vertically arranged filaments. Its practical construction comprises a metal disk formed into the shape shown in the illustration, and enameled with white enamel or vitreous porcelain. The deflectolier has receptacles at four points, each corresponding to its vertical axis and located ninety degrees apart. In the center there is a receptacle in which the fifth lamp is placed, depending considerably below the others. This lamp forms a central diffusion point for the light which acts to supplement the distributed diffusion points.

DEFLECTOLIER EQUIPPED WITH TUNGSTEN LAMPS.

As is well known, ceiling illumination requires very good diffusion in order to obtain satisfactory results. By the deflectoliers, it is said, there is secured a diffusion which is sufficiently perfect for any ordinary purpose, by the use of the white enamel surface and the shape adopted to give as perfect a diffusion as is mathematically possible.

Another notable feature of the deflectolier is the attractive design, permitting its use both in the home and in the store or office.

The deflectolier is secured direct to the ceiling and is wired complete at the factory. One shade holder is provided for the central lamp. They can be installed wherever an arc lamp, gas lamp or any lighting fixture can be placed. Deflectoliers should always be controlled by wall switches, and they are frequently arranged with two and sometimes three switches to separately control the lamps, allowing when thus arranged the use of one, two, three or all five lamps as desired.

The deflectolier is being manufactured and placed on the market by Edward J. O'Beirne and Company, Elgin, Ill.

New General Electric Plant.

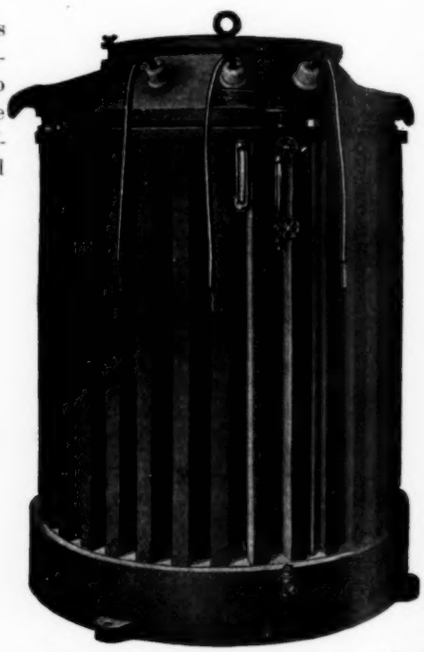
The General Electric Company is ready to award the contract for a $200,000 addition to its present Toledo plant on Chestnut street. Bids have been received and sent to the home office of the company, and it is expected that work on the building will be under way within a week. The new structure will be 300 feet long, 80 feet wide and four stories high, and will be entirely of fireproof, concrete and steel construction. It will give the local plant a daily capacity of 20,000 incandescent lights, and when completed will be the largest bulb plant of the company. Its products will be largely the Mazda lamp.

Several superintendents and other officials of the concern held their annual meeting a short time ago for the purpose of talking over matters relative to the management of affairs.

Kuhlman Three-Phase Transformers.

A new line of three-phase transformers has been placed on the market by the Kuhlman Electric Company, of Elkhart, Ind. These transformers embody a number of new features, among the most marked being the provision of three magnetic circuits of equal resistance in the core. These are interconnected just as the windings of a three-phase generator or motor. As a result of this construction of the core, which is distinctive of these transformers in comparison with all other makes of three-phase transformers, it is possible to maintain a much more perfect electrical balance at all points of loading. Non-aging silicon steel is used for the cores.

The coils are built of the most carefully selected materials and are thoroughly insulated. The primaries are star-connected and the secondaries delta-connected in the standard transformers. Liberal oil ducts are provided throughout the core and windings, thus permitting unimpeded circulation of the oil. With this provision and the ample case radiation it is possible to keep the maximum temperature rise below forty-five degrees centigrade under normal conditions.



NEW TYPE, THREE-PHASE TRANSFORMER

As these transformers are primarily power transformers and operate in most cases at practically full load while in operation at all, the designers have con-

trived to make the core and copper losses nearly equal, which results in maximum efficiency at the full-load point and also gives high regulation and liberal temporary overload capacity.

These transformers, of course, possess the marked space economy of all three-phase transformers as contrasted with three single-phase units. Moreover, they have the further advantages of decreased cost, higher efficiency, simplicity of installation and improved appearance as compared with a bank of three single-phase transformers. The present line of Kuhlman three-phase transformers is designed for 2,200-volt, sixty-cycle circuits and ranges in size from five to 100 kilowatts. For the smallest size the efficiency ranges from 97.1 to 96.6 per cent from full load to half load. In the 100-kilowatt size these figures are 98.5 and 98.1 per cent respectively.

KUHLMAN POLE-TYPE THREE-PHASE TRANSFORMER.

Indiana Telephone Property Valuation.

The Indiana State Board of Tax Commissioners have reported the valuation of telephone property under their jurisdiction subject to assessment to be $11,181,013. The valuation of these companies was decreased on the aggregate of $259,048 while the valuation of nine of the larger companies was increased $701,485 over the valuation reported last year.

The Hartford Time Switch.

The large capacity time switches recently added to the standard line of Hartford time switches are the result of several years of experience in building switches of this character to meet all conditions of service. Heretofore it has not been found satisfactory in actual practice to control lines carrying over fifty to seventy-five amperes by time switches except through the medium of solenoid operating oil-break switches. Such switches have been expensive and the present large capacity of Hartford time switch automatically controlling up to 300 amperes in single, double or triple-pole, as well as high potential currents up to 2,500 volts will be welcomed by all users of this class of material.

In these switches the patented controlling mechanism is of such construction as to make it impossible for the switch to fail in action, either through derangement of the mechanism or through failure to wind the time mechanism.

LARGE CAPACITY, HARTFORD TIME SWITCH.

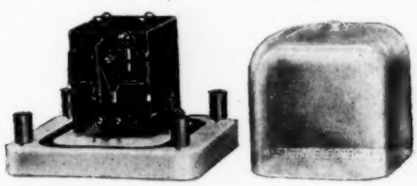
In the Hartford large capacity switches a standard knife switch of ample capacity is used and this is operated by a quick break mechanism which is absolutely positive in its action regardless of the state of winding or tension of the controlling springs of the clock work mechanism. The throwing mechanism is entirely separate from the timing mechanism, so that though the clock may run down if forgotten the switch cannot stop except at the extreme off or on point and the quickness of break is in no way affected. This device is supplied in a waterproof iron case, the door locking with a sub-treasury lock. The time mechanism used is a high grade eight-day marine movement which has proven itself by many years of satisfactory service. High-potential switches break in oil.

General dimensions over all are 19½ inches high, 9¾ inches wide and 7½ inches deep.

A New Telephone Selector.

After having undergone successfully a service test on one of the busiest stretches of track to be found on any railroad of the United States, the new selector recently developed by the Western Electric Company, New York and Chicago, is now complete. Engineers have been working in conjunction with prominent railroad men on the development of this apparatus for more than a year. The final model was made several months ago and the trial installation, which was even more successful than had been expected, followed immediately.

This selector is fully up to the standard of the "Bell" grade telephone apparatus. During the past few days prominent superintendents of telegraph have been visited by railroad experts of the Western Electric Company with a view to placing orders for the new equipment. Orders already have been received for three of the largest railroad systems.



WESTERN ELECTRIC TELEPHONE SELECTOR.

The new selector is a very simple device, being a straight step-by-step mechanism with but three moving parts, bridged directly across the line. There is only one contact made and as all relays and other complicated parts are eliminated it is claimed that the selector is as near perfect as it is possible to make it. Central-battery ringing is provided for, thus doing away with the necessity of installing dry batteries at the way stations. The selector is also arranged for local-battery ringing if desired.

A New Signaling System for Mines.

The Western Electric Company, New York and Chicago, announces that it is prepared to furnish a new design of emergency signaling apparatus for mines which complies fully with the laws of Illinois and other states regulating the use of telephones and emergency signaling systems in mines.

The new signaling system consists of a generator signaling set and the regulation emergency eight-inch signal bells or gongs. The generators used in the signaling sets are designed in two sizes to accommodate systems which require a large or small equipment of gongs.

The smaller of the two generator equipments consists of a five-bar magnet generator mounted in an iron case, as shown in Fig. 1. In appearance this case is similar to that of the new mine telephone set which the Western Electric Company placed on the market a few months ago. This five-bar generator will operate the equivalent of twenty eight-inch, loud-ringing extension bells over eight miles of full metallic No. 12 B. W. G. iron wire. The magnets of the generator are of the highest grade magnet steel and are hardened and aged to insure retaining their strength indefinitely. The bearings are large and well proportioned and the crank furnished is of a design which enables the generator to be rung easily when fully loaded.

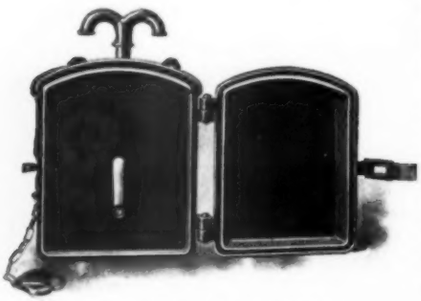


FIG. 2.—SIGNAL SET, OPEN.

The larger signaling set consists of a fourteen-bar magnet generator mounted in a metal case similar to that of the five-bar magnet equipment and is similar to that equipment in every detail except size. This generator will ring the equivalent of sixty eight-inch-gong emergency bells over an eight-mile line.

In each of these types the generator is arranged in an iron box provided with a padlock, ordinarily to be kept locked. To protect the generator when the outer door of the box is opened, a steel cover is fastened over the opening of the box and in front of the generator. This cover removes the possibility of any part of the clothing of the party operating the generator being caught in the generator wheels and also protects the generator from interference by other foreign substances which might collect should it be exposed while the door is open.

FIG. 1.—SIGNAL SET, CLOSED.

A compartment in the front of the door of the box equipped with a glass front is provided for the key to the set. It is the intention that a key to the set shall always be kept in this compartment and that this key will be used only in cases of emergency, when anyone may break the glass front and obtain the key to open the set. This compartment is to be made air-tight so that it will be impossible for dust to get inside and hide the key from view. The back of this compartment is to be painted white so as to make the key more noticeable.

It is also intended that the foreman or man in charge of the mine shall be provided with an extra key to enable him to open the box under ordinary conditions in the mine when it is desirable to operate the generator for fire or emergency-call drill.

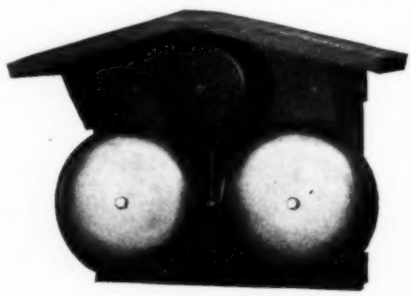


FIG. 4.—SIGNAL GONGS.

The same precaution against water following the line wire into the case of the signaling set is taken as in the Western Electric new design of mine telephone. The curved inlet at the top provides an entrance which removes the possibility of water flowing in.

The emergency signal bell used with the generators consists of a non-sparking bell provided with two eight-inch steel gongs mounted upon a wooden or steel backboard and having a protecting canopy. The gongs are hot galvanized and have especially loud and clear tone. All parts, including the windings, are treated to stand conditions of mining atmosphere.

"Tests with Paper Free Mica Tubes."

TO THE EDITOR:

In your issue of May 21 on page 1077 we find an article headed "Tests with Paper Free Mica Tubes." We believe that this article must have been written by you without a clear conception of the matter.

FIG. 3.—INTERIOR OF SIGNAL SET.

We beg to advise that the word "Micanite" is a registered trade mark name, descriptive of the products manufactured by the Mica Insulator Company solely. No other company has the right to use this word in connection with material manufactured by them. You will, therefore, see that the phraseology used in your article severely reflects upon the product manufactured by this company.

We can hardly think that you intended to make this reflection. As a matter of fact the article is misleading and is not in accordance with the actual practice of our company. We can and do make mica tubes without paper, when demanded by the trade.

MICA INSULATOR COMPANY.

[The item was contributed by one of our foreign correspondents and no reference to or consideration of micanite as other than a general descriptive term was intended.—EDS.]

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, MAY 20.—A noteworthy addition has been made to London's electric power stations by the opening of the new works of the Westminster Electric Supply Corporation in Westminster. The new station takes the place of one of the first electric power houses built in London, which we credit in the early eighties upon the river Thames. The site was compulsorily acquired a few years ago by the London County Council in connection with a street improvement and an agreement was made for finding the Company a new site, and the payment of the cost of erecting an equivalent power station. The company has naturally taken the opportunity to erect a thoroughly modern plant and the exchange between the two sites has resulted in some more or less complicated financial arrangements. The new buildings have a capacity for 6,600 kilowatts of generating plant, and 15,000 kilowatts of converting plant. Two points in the arbitration proceedings over the exchange of sites stand out. The old site was on the river and consequently coal was brought by water. Now all coal has to be carted, but a payment has been made in respect of this. The other dispute was in respect of condensing water, which of course, was easily obtained before. The London County Council have now provided a subway about 300 yards long in which are laid four twenty-inch pipes, and the arrangements are of an elaborate character, including provision for altering the direction of flow of water at will, and the installation of rotary strainers upon a principle adopted by the City of London Electric Supply Company, and the London County Council at the tramway powerhouse at Greenwich. The main generating sets are Zoelly turbines coupled to 500-kilowatt Siemens continuous-current dynamos. The station supplies a compact area in close proximity, there being no long distance transmission. Tests with the turbines have given a result of slightly over seventeen pounds per kilowatt hours, and although this does not compare with the figure of thirteen pounds which has been obtained at Newcastle with some Curtis turbines, the makers do not regard this result as the best which the Zoelly turbine is capable of.

The fate of surface-contact traction in Great Britain is being gradually sealed. The one important installation in this county now is the Dolter system at Torquay, the only other example being a short length of track—also on the Dolter systems—along the sea front at Hastings where the process of renewing the studs seems to afford continuous work for a man and a boy. The system has never been economical to work, and a short while ago the corporation was asked to give its permission to the substitution of the overhead system. Already upon an extension line the trolley has been installed. In October the Board of Trade license for the working of the system expires, and so bad is the operation that the Board has threatened to refuse to renew the license. Having educated the public to realize the advantage of tramways, it is conceivable that the operating company looks to public opinion to assist it in its desire to abandon surface contact. The prospect of a discontinuance of the whole service will certainly provoke rapid action by the inhabitants.

It has been decided by the Bournemouth corporation to abandon the conduit system of electric traction on account of expense of maintenance, and to replace it by the overhead system. Here again it is clear that the public antipathy to the trolley system, which was so prominent when tramways were first introduced into Bournemouth, has largely disappeared. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., MAY 28.—The bylaw to raise, by debenture, the sum of $82,000 for power development has been carried by the ratepayers of Renfrew, Ont.

Two bylaws, one to raise $39,000 to acquire the plant of the Ingersoll Electric Light and Power Company and the other to raise $15,000 to make improvements and extensions to the plant, have been carried by the town of Ingersoll, Ont.

It is taken for granted that the extensive program of extension by the Toronto Railway Company, just authorized by the Railway Board of Ontario, will mean a new stock issue. An expenditure of over $2,000,000 is indicated.

The New Brunswick Telephone Company, of St. John, N. B., with a plant valued at over a million and a quarter dollars, earned $271,738 last year, added $40,000 to reserve, paid a six-per-cent dividend and had a surplus of $1,144.

The Dominion Power and Transmission Company, of Hamilton, Ont., has plans under consideration to erect a car building plant in that city, to manufacture cars and equipment for the local street railway and suburban trains controlled by it.

The Dominion Light, Heat and Power Company, of Montreal, has sent to the city council a categorical denial of the assertion, made at a recent meeting of that body, to the effect that the company was not in a position to take over the work of lighting the streets of Montreal.

The water commissioners of the city of London, Ont., who are handling the supply of Niagara power, have decided on a reduction in the rate for domestic lighting. The new rate will figure out at about four and one-half cents. The London Electric Company is offering light at five cents a kilowatt hour on a continuous basis, and the city will cut under that figure. Citizens now pay nine cents per kilowatt hour in London and the city is prepared to make even a greater reduction should the local light company meet the city's rate.

The appointment of a permanent commission to deal with disputes between the United States and Canada, on all matters affecting international waterways, is likely to be made before long, under the provisions of the new waterways treaty. It will replace, in its functions, the existing international waterways commission, but in addition to permanency, will be clothed with greater authority. Enquiry in official circles here with reference to the Long Sault power scheme, elicited the information that this project will be one to be dealt with by the new commission, and that any further action regarding the matter will be under the treaty. The Long Sault daw project has been before the commission for some time, but no report is anticipated in the near future, and, in view of the new turn of affairs, it now seems that anything the commission may propose will be only a recommendation to the new body, which, under the treaty, will have to deal with it. W.

LIGHTING AND POWER.

(Special Correspondence.)

GRANGEVILLE, IDAHO.—It is proposed to establish a $50,000 electric-light plant in this city.

PALMYRA, MO.—This city has voted $35,000 of bonds for the purchase of an electric light plant. P.

AURORA, MINN.—Bonds for $10,000 have been voted with which to install an electric light plant. P.

BOONE, IA.—The Boone Electric Company has secured a twenty-five-year franchise and will expend $25,000. P.

HEMPSTEAD, TEX.—J. C. Amsler and others have organized an electric-light company with a capital of $10,000. P.

GLEN ELDER, KAN.—John Abraham, of Waconda Springs, will install an electric-light plant here to cost $10,000.

SAFFORD, ARIZ.—At a bond election held recently it was voted that a municipal lighting plant be installed here.

TYNDALL, S. D.—It has been voted to install a municipal electric lighting system at a cost not exceeding $16,000. C.

SALINAS, CAL.—The Globe Electric Company has been awarded the contract for installing an electric lighting system here.

PE ELL, WASH.—The council granted a franchise to L. A. Webb, of Aberdeen, Wash., for the installation of an electric light plant. C.

SPUR, TEX.—E. P. Swenson will install an electric light plant at Spur. The contract was let to J. E. Johnson, of Stamford, Texas. D.

PELICAN RAPIDS, MINN.—Bonds for $5,000 have been voted to reconstruct the electric light plant to operate it by water power. P.

MEDORA, ILL.—The Medora electric-light plant has been bought by George C. Robinson, of Hettick, who owns a large amount of property here.

BOONE, IA.—A twenty-five year franchise has been voted to the Boone Electric Company and $50,000 will be expended in improvements and extensions.

TERRELL, TEX.—The city will install additional dynamos in its electric light and power plant. The plant is now furnishing day and night light and power service. D.

TACOMA, WASH.—It is proposed to take a vote on issuing bonds for the addition of 72,000 horse-power to the city's electric power supply, estimated to cost $2,246,970. C.

OROVILLE, CAL.—The Valley Counties Power Company is planning to erect a power plant here. The present supply is being received from the Great Western Power Company. A.

SAFFORD, ARIZ.—S. S. Campbell of Boston has been granted an electric light and water franchise. Mr. Campbell will proceed at once with the erection of his electric plant and reservoir.

PORTLAND, ORE.—The Government Standard Power Company is planning to invest $25,000 in a power plant near Astoria. The construction work is expected to begin in September of this year. A.

NEW RICHMOND, WIS.—The New Richmond Roller Mills Company is installing an electric water-power plant on Apple River west of here. The power will be largely transmitted to this place. M.

CLAY CENTER, NEB.—M. M. Johnson will build a new electric light plant during the summer, consisting of a brick building, brick smoke stack and fireproof roof. A new dynamo will be installed. C.

ASOTIN, WASH.—The Grande Ronde Power Company has been incorporated by Geo. W. Bailey, L. K. Alderson, C. Evans, F. E. Brown, E. Winders, W. F. Jones and C. McNary, with a capital stock of $1,000,000. A.

OMAHA, NEB.—Structural-steel work has been started on the new power plant of the Omaha & Council Bluffs Street Railway Company. It is expected that the station will be ready to furnish power by December 1.

NELSON, B. C.—The International Electric Company has been incorporated with a capital stock of $1,000,000 to develop hydroelectric power from the falls at the junction of the Salmon and Pend Orielle Rivers, Oregon. A.

TACOMA, WASH.—L. A. Webb has been granted a franchise for an elestric lighting system. Construction work will commence at once on a power site on the Chehalis River where a concrete dam will be erected. A.

SAN FRANCISCO, CAL.—The Pacific Power Company has been incorporated by A. E. Anderson, G. W. Hendry and James McNab, with a capital stock of $1,000,000. The principal place of business is San Francisco. A.

SAN FRANCISCO, CAL.—The Central Power Company has been incorporated by J. J. Lermen, S. D. Woods and R. W. Dennis with a capital stock of $50,000. The principal place of business of this company is San Francisco. A.

YUBA, CAL.—The Middle Yuba Hydroelectric Power Company will this summer begin operations on its power project on the Middle Yuba Alver below Graniteville. The company intends to supply Alleghany with power. A.

SAN BERNARDINO, CAL.—The Los Angeles County Pacific Electric Company, controlled by the Huntington interest, is to run lines to San Bernardino, Riverside, Redlands and Colton. Construction work will begin some time in June A.

DEFIANCE, OHIO.—T. T. Ansberry, H. D. Bokop and M. W. Steinberger, representing the Valley Power Company, have accepted the franchise to supply electric power in this city. The Auglaize River will be used to develop the electricity. H.

INDIANAPOLIS, IND.—The White River Power Company has been incorporated to construct and operate an electric plant. The capital stock is $10,000. Directors are: G. T. Freeland, J. W. Monical, Milt Meyers, J. F. Scherschel and A. T. Fountain.

RANDOLPH, VT.—The Bethel Electric Company has offered to sell its electric light plant to this village for $60,000. More than $100,000 has already been spent on the plant. Should the village not desire to buy, it may take the plant under a five-year lease.

SAN FRANCISCO, CAL.—The Artificial Light Committee of the Board of Supervisors is working on a plan to adjust inequalities so that all sections of the city may have a proportionate share of street illumination with a corresponding equalization of the cost. A.

CLINTON, N. C.—The Sampson Power Company has secured a site and will erect a power plant, with headquarters at Clinton, to supply electric power. The incorporators of the company are C. W. Petty, B. P. Smith, and several others. Capital stock, $10,000. L.

SAN FRANCISCO, CAL.—The Pacific States Electric Company, San Francisco, Cal., will open a branch office in Portland, Ore., at No. 90 and No. 94 Seventh Street about July 1. The company also contemplates opening up branches in Seattle, Tacoma and Spokane in the near future.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed by the Thomas Gas, Light and Power Company of California. One-half of the $50,000 capital stock has been paid up. The directors are: R. Thomas, W. J. Schmalle, J. Weirich, W. W. Haslehunt and F. O. Schmalle.

KIRKSVILLE, MO.—The Chariton River is to be dammed to supply power to Kirksville. A power dam is projected to cost from $75,000 to $100,000. It is proposed to pump water six miles and also light the city. It is believed the current will be sufficient to supply small factories.

NEW MARKET, IND.—The New Market Light Company has incorporated for the purpose of erecting and equipping a plant to furnish light, heat and power to the citizens of New Market and community. The directors are W. V. Yount, N. J. Mills, L. B. Elter and Alberti Hinipierer.

BRIDGEPORT, CONN.—Plans are in preparation for alterations and extensions at the plant of the United Illuminating Company to meet the expected increase of business. An addition to the building will be made and new generators added, which will materially increase the capacity of the plant.

FT. WAYNE, IND.—The Ft. Wayne and Wabash Valley Traction Company has decided to build a new substation near Kingsland on the Muncie Division. When the station is completed the company will cease to buy power from the Indiana Union Traction Company's power plant at Bluffton. S.

SULLIVAN, IND.—The Sullivan County Electric Company has been incorporated with a capital of $60,000 to furnish electric light to Sullivan, Shelburn, Farmersburg and other towns. The directors of the company are Henry C. Dies, Mark E. Nebeekr, Chester M. Poor, David McBeth and John W. Robb.

PORT HURON, MICH.—The Port Huron Light and Power Company has opened its new downtown office, which is located in the building on Huron Avenue, formerly occupied by J. B. Haviland. The office is one of the finest in the city. The company will also operate a store where electric-light fixtures may be purchased.

GRAND RAPIDS, WIS.—The Consolidated Water Power and Paper Company will furnish power to the Grand Rapids Street Railroad Company, operating an interurban between Grand Rapids and Nekoosa. The power company is preparing to install a rotary converter to transform part of its current from alteratning to direct. M.

NEVADA CITY, CAL.—The Northern Water and Power Company, which owns a system of storage reservoirs in the mountains north of this city, will commence operations upon the Sawmill Flat reservoir. The company intends to raise this dam in order to increase its storage capacity. The work will be completed this summer. A.

NEW YORK, N. Y.—H. L. Doherty & Company, announce that they have purchased from W. A. Williamson and C. M. Warner the Bristol Gas and Electric Company, of Bristol, Tenn. The city of Bristol has a population of about 26,000 and the company referred to above controls its gas and electric business, having no competition.

OWENSVILLE, IND.—Plans are under way to make the Owensville electric light plant a central generating station for all the inhabitants, including farmers, within a radius of from three to five miles. The local plant is within easy reach of a large number of farmers whose premises are not widely separated and the cost of connection will not be great.

QUINCY, CAL.—The Feather River Power and Development Company is engaged in developing a hydroelectric power proposition on the middle fork of the Feather River, below Nelson Point. The project includes the erection of three plants capable of producing under natural conditions and without the assistance of storage reservoirs, a total of about 5000 horsepower. A.

ATLANTIC CITY, N. J.—A large electric-light plant is to be erected by the water department of the pumping station in Absecon. Bids for the new plant have been received and the contract is soon to be awarded. The plant is to furnish the illumination for the pumping stations and the surrounding grounds and will also be of sufficient capacity for driving two of the smaller pumps.

PHOENIX, ARIZ.—A company has been formed by Los Angeles and Eastern people, with a capital stock of $2,000,000, to build a dam at Striped Canyon near the confluence of the Big Sandy and Santa Maria creeks. It is estimated that this dam will primarily create more than 3000 electric horsepower which will be carried to the mining camps in Mojave and Yuma Counties. A.

SAN FRANCISCO, CAL.—Incorporation papers of the Pacific Power Company have been filed in the office of the county clerk. The new concern contemplates the acquisition of watersheds and watercourses. Its chief place of business will be San Francisco. The incorporators are James McNab, George W. Hendry and A. E. Anderson, each of whom subscribed for $10 of the $1,000,000 capital stock.

SULLIVAN, IND.—The Sullivan County Electric Company has been incorporated, capitalized at $60,000. The object of the corporation is to construct, equip and operate a plant to furnish the Sullivan, Farmersburg, Shelburn and other towns and the citizens generally of the community electricity for light, heat and power purposes. Henry C. Dies, M. E. Nebeker and C. M. Poor are directors. S.

GUTHRIE, OKLA.—A charter has been granted to the McKenna Power Development and Irrigation Company of Ada, with a capital of $50,000. The company purposes to develop power from the Canadian River, to operate electric interurban lines and irrigate lands in the vicinity of the plant. The incorporators are Dr. J. J. and Dell McKenna of Oklahoma City, J. E. Smith, M. L. Wall and A. H. Constant.

EPHRATA, N. Y.—The Mohawk Hydroelectric Company of Ephrata, Fulton County, has been incorporated with a capital of $10,000, and will construct dams across Peck and Garoga lakes to

generate electricity for light, heat and power purposes. The directors are S. A. Thorensen, James B. Huff of New York, Allen J. Nichols, of Brooklyn; H. M. Brinckerhoof of Ossining; William P. Dunlop, of Yonkers.

VALDOSTA, GA.—The work on the new power house for the Consolidated Light and Power Company is to be pushed as rapidly as possible and it is expected that the new machinery for the plant will reach Valdosta in a short time. Much of it will be put in position before the house is completed. The plant is to be of sufficient size to furnish power and light for fifteen years hence, or when the town reaches a population of twenty-five thousand.

BEACHVILLE, CAN.—The Beachville Improvement Society is making arrangements for hydroelectric power, and will generate some 200 horsepower for lighting, etc. It is also having the West Oxford township council take up the matter and at an early date it is expected that the council will submit a bylaw to the township to supply power and light off the low tension line from Woodstock to Ingersoll. The council is already practically committed to the matter.

OGDENSBURG, N. Y.—The bill incorporating the St. Lawrence Power Transmission line has passed the Canadian Senate and is now a law. Within the next eighteen months the company is to erect transmission lines along the Canadian sides of the St. Lawrence River, and develop the surplus power between Brockville, twelve miles west of here, and a point twenty miles down the river. The company already has a power house at the Long Sault rapids, and cheap power now seems a certainty.

SPOKANE, WASH.—The Washington Power Company has purchased the lighting and power plant of the city of Colfax for a consideration of about $100,000. The deal involves the taking over of all franchises, pole lines, office fixtures and other property of the old firm of MacKenzie & Codd, which for ten years has operated the Colfax Light and Power Company. F. R. Fantom, who has been connected with the commercial department of the W. W. P. in Spokane, will be superintendent for the company at Colfax.

NEILLSVILLE, WIS.—The Neillsville Electric, Water and Supply Company has increased its capital stock to $30,000 and is preparing to build a dam across Black River, two miles north of this place. The original plans were to erect the structure further up, but at the new location a much greater head can be obtained. Between 800 and 1,000 horsepower will be generated. The dam will have its foundation on the solid rock bottom of the river, with rock cliffs on the east side. The power house will be built into the dam. M.

SANTA FE, N. M.—The articles of incorporation of the San Luis Power and Water Company of Costilla, Taos County, have been filed in the territorial secretary's office here. It has a capital stock of $1,000,000. The incorporators are H. Alexander Smith, George Bierbrauer and Michael B. Hurley, all of Colorado Springs, Colo. The board of directors are named as follows: Franklin E. Brooks, Gerald Hughes, Fred Hughes, Fred C. Moffat, Horace G. Lunt and H. Alexander Smith. The company is authorized to operate in Taos County, New Mexico, and in El Paso County, Colo.

OWOSSO, MICH.—Announcement was made that the property and franchise of the Owosso & Corunna Electric Company will be sold at public auction by the sheriff June 17. It has been generally understood that the Commonwealth Power Company was to take over the local company, but it appears that the sale has been ordered by the United States court to satisfy a mortgage held by the Fidelity Trust Company of Baltimore. The Owosso & Corunna Electric Company operates a car line between the two cities and has a power plant at Corunna. It has been operating under a receivership for some time.

HOOD RIVER, ORE.—The Hood River Electric Light and Power Company has transferred its light and water systems to the Hood River Light and Power Company, of Portland, of which J. D. Wilcox is president, Robert Smith vice-president, and Mirt Minor secretary. The plant sold for $112,000. The new company has taken charge and will at once proceed with the betterment of the water system and the building of an electric line through the valley. The projected electric line will open a vast district, which is said to be excellently adapted for fruit culture. The line will also prove of great value to the lumber manufacturing industry in the Hood River valley.

NINETY-NINE ISLANDS, S. C.—The latest addition to the series of hydroelectric plants of the Southern Power Company, is the plant at Ninety-Nine Islands, on the Broad River, in South Carolina ,about four miles from Gaffney, S. C. It is the first power plant which the company has built partially on contract, including the long dam across the river. The plant has a capacity of approximately 24,000 horsepower and is one of the finest and most complete yet erected by the Southern Power Company. The location of the plant is also very convenient relative to the consuming sources of the power generated by the company. L.

COLFAX, WASH.—F. R. Fantom, of Spokane, has taken the management of the electric-light plant of this city, Codd & MacKinzie having sold out to the Washington Water Power Company, of Spokane. The deal has been held up for some time, as the Codd & MacKinzie franchise only called for lighting privileges. Heating and power privileges were added by the city council and the deal was closed at once. The consideration was not made public. The property includes the construction throughout Colfax, several lots and the old light plant used for emergency cases. The franchise runs fourteen years. Reliable information as to the consideration says about $80,000. Remodeling will soon commence on all South Colfax construction, costing several thousand dollars. The old plant will be remodeled for emergency cases, and the power line to Spokane is being strengthened to insure best of service.

ATLANTA, GA.—The entire property of the North Georgia Electric Company was sold at auction recently at Gainesville to S. F. Smith, of York, Pa., for $400,000. The sale was conducted by the receiver, H. H. Dean, and was the result of foreclosure proceedings brought in the federal court two years ago by the Knickerbocker Trust Company, of New York. The property sold included the Dunlap plant, the transmission lines from Gainesville to Atlanta and the Tallulah Falls property. It is understood that the property will be turned over to the Georgia Power Company by Mr. Smith and that the business will undergo a thorough reorganization, supplying electrical power to Atlanta and its vicinity and the towns between Gainesville and Atlanta. The Georgia Power Company is already incorporated by the Hall superior court, and recently secured permission from the railroad commission of Georgia to issue $6,000,000 worth of bonds and several million dollars of capital stock with which the property of the old company will be purchased and the rest used for raising money to develop the plant.

MAUMEE, OHIO.—The Phoenix Light and Power Company for which R. R. Livingston is consulting engineer, is developing a water-power site near here and has placed an order with Allis-Chalmers Company for the necessary machinery. This will consist of two twenty-six-inch twin horizontal center-discharge hydraulic turbines enclosed in plate-steel cylindrical casings. These will operate under an effective head of sixty-one feet. They will be directly connected to two 937 kilovolt-amperes, 2300-volts, three-phase, sixty-cycle, alternators, with direct connected exciters, twenty kilowatts each. There will also be furnished one 450-kilovolt-amperes, 2,300-volt, three-phase, sixty-cycle, 240-revolution-per-minute alternator to be connected to an existing turbine.

GREAT FALLS, S. C.—The Republic cotton mills now has under construction a mill which will be one of the largest and most modern in the South. All machinery will be driven by electric motors, the four-frame drive being employed. Power will be obtained from the Southern Power Company. The contract for the electrical equipment has been awarded to Allis-Chalmers Company and includes the following: Twenty-two twenty-horsepower, twelve ten-horsepower and one five-horsepower squirrel cage induction motors; one 125-horsepower, two 100 horsepower, two seventy-five-horsepower and one fifty-horsepower wound rotor induction motors, three 200-kilowatt-ampere, 2,200-600-volt oil-filled, self-cooled transformers, two twenty-five-kilovolt-ampere, 2,100-105 volt transformers and an eleven panel switchboard.

STURGIS, MICH.—For several months the city has been considering the question of securing a municipal power plant to furnish energy for lighting the city and operating the pumps. On the recommendation of the engineer who has been making the investigation, it was decided to build a hydroelectric plant on the St. Joseph River at Lelands at which place the city had secured options on a power site. This is twenty-three miles from Sturgis and it will require quite an elaborate transmission line to deliver the power. At a recent meeting of the council a contract was awarded to Allis-Chalmers Company for the necessary apparatus for this plant. This includes an 800 horsepower single-runner vertical-shaft turbine designed to operate under a maximum head of twenty-five feet. Direct connected to the turbine will be a 550-kilowatt-ampere 2300-volt, sixty-cycle three-phase alternator. A forty-kilowatt direct current generator driven by a sixty-seven horsepower vertical-shaft turbine will furnish exciting current. Six 200 kilowatt-ampere, 23,000/2300-volt transformers will make the necessary transformations at each end of the line. A threaded-panel switchboard will be installed for controlling the apparatus.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SIOUX CITY, IA.—The Sioux City and Eastern Interurban Railway Company has been incorporated with a capital stock of $100,000. P.

ROME, GA.—It is announced that the capacity of the power house of the Rome Railway and Electric Company will be doubled within one year. New and better schedules have recently been put on, and extensions made to the lines. L.

DES MOINES, IOWA.—F. C. Hubbell, B. F. Kaufmann and G. M. Hippee have been appointed a committee to secure the construction of an interurban line, 100 miles long, to Red Oak, via Greenfield. C.

SAN FRANCISCO, CAL.—The Marysville and Colusa branch of the Northern Electric Company, has been incorporated by C. H. Hannon, L. J. de Sabla, S. Lilienthal, G. E. Springer and H. W. Furlong, with a capital stock of $1,500,000. A.

GRAND RAPIDS, MICH.—Subscriptions for stock in a new

interurban company to connect Grand Rapids, Hastings and Battle Creek are being taken in the three cities, and according to the promoters of the scheme the road will be completed by September, 1911. Local capitalists are subscribing $75,000.

FREMONT, OHIO.—The council of Fremont has granted a twenty-five-year franchise to the Fremont Street Railway Company. It is understood that the franchise and local property of the company will be turned over to the new Fremont-Fostoria Company, which will build its lines into the city this summer. H.

BELTON, TEX.—The Belton-Temple Traction Company's interurban line, with all equipment, has been sold by a receiver under an order of the federal court. Little and Abrene purchased the road for $25,000. The Temple Electric Light Company's plant was also sold here to George C. Pendleton for $32,500, subject to a prior mortgage of $16,000.

TRENTON, N. J.—The Camden & Trenton Traction Company has been incorporated with a capital of $675,000. The company will operate a trolley line btween Trenton and Camden. The incorporators are Frensinger Evans, Eugene A. Martin and Charles R. Renz. These men are purchasers of the Camden & Trenton Street Railroad Company, which was sold some time ago by a receiver.

SALISBURY, N. C.—It is stated, unofficially, that the Piedmont Railway Company has taken over the properties of the Salisbury-Spencer Railway Company. The Piedmont Company is headed by W. F. Snider, T. H. Vanderford, T. J. Jerome, M. L. Jackson and others, and operates a line three miles long. The Salisbury-Spencer company is the first street railway company ever organized in this city. It is also stated that the Southern Power Company is behind the deal, and that the line is to be made a link in the interurban line from Charlotte to Greensboro.

WALLA WALLA, WASH.—Articles of incorporation of the Walla Walla Railroad Company, which announce that the company will operate street railway lines in and out of Walla Walla, Wash., have been filed with the county clerk. The company is incorporated for $500,000, divided in shares of stock at $100 each. The incorporators are Lewis A. McArthur, R. D. Greer and E. D. Hanna. It is set forth in the articles of incorporation that the company plans to construct an electric line from Walla Walla to Milton, Ore. It is provided that the company will have a right to sell to or consolidate with any other railroad company.

SIOUX CITY, IA.—The Sioux City and Eastern Traction Company, which proposes to build an interurban railway from this city to Denison, Ia., by way of Climbing Hill, was organized a short time ago. It is hoped that stock will be subscribed to the extent of from $8,000 to $10,000 per mile. The remainder will be met by a bond issue. The directorate is made up as follows: A. H. Tennis, Sioux City, president; W. B. Goodrich, Climbing Hill, vice-president; H. C. Fedderson, Luton, treasurer; W. L. Harding, Sioux City, secretary; C. S. Malcom, Climbing Hill; W. H. Steinhauer, Climbing Hill; Wm. Hanner, Climbing Hill. On the executive committee will be A. H. Tennis and W. L. Harding. Walter H. Foss, of Minneapolis, was elected superintendent in charge of right of way, stock selling and general promotion of the road.

SAN FRANCISCO, CAL.—Articles of incorporation of the Northern Electric Railway Company, Marysville and Colusa branch, which contemplates the construction of a line which will tap one of the richest farming districts in the Sacramento Valley, were filed recently. The new corporation has a capital stock of $1,500,000, divided into 15,000 shares of $100 each. The amount already subscribed is $30,000, of which Charles H. Hannon of Berkeley has taken $28,000; Leon de Sabla, $500; Samuel Lilienthal, $500; George E. Springer $500, and Herbert W. Furlong, of Pleasanton, $500. The road, starting at Marysville, Yuba County, will run through Yuba City to Colusa, on the western bank of the Sacramento River, a distance of thirty miles, serving the territory of Grant Island, lying between Hamilton, where large beet sugar refineries are located, and Grimes.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

SCRANTON, ARK.—The Scranton Telephone Company has been incorporated with a capital of $4,000. P.

HIGGINS, TEX.—The Home Telephone Company has been incorporated with a capital stock of $2,000. P.

WATERTOWN, MINN.—The Watertown Telephone Company has increased its capital stock to $50,000. P.

JAVA, S. D.—The South Spring Lake Telephone Company has been incorporated with a capital stock of $2,000. P.

ABINGDON, ILL.—The Mutual Telephone Company has completed the installation of ten miles of new lines. Z.

WOODWARD, OKLA.—The Economy Telephone Company has been incorporated by Will White, C. O. Baker and others. P.

GUNDER, IOWA.—The Marion Telephone Company, of which A. S. Haug is secretary, has been incorporated with a capital of $4,000. C.

DAVENPORT, IOWA.—The Iowa Telephone Company let the contract to Dan Ryan for underground conduit work amounting to $20,000. C.

MOOSE JAW, SASK.—The contract for the erection of the provincial government telephone building has been let to Navin Bros. at $25,713. C.

CANTON, ILL.—The Canton Home Telephone Company and the Farmers' Lines' exchange have geen connected with a trunk line, giving inter-service. Z.

WHITE ROCK, S. D.—The Roberts County rural telephone will be connected with the Browns Valley local system and the Tri-State long-distance system. C.

SAUK CENTER, MINN.—The Northwestern Telephone Exchange Company will expend $25,000 to $30,000 for the installation of a magneto telephone system. C.

EAU CLAIRE, WIS.—The Wisconsin Telephone Company is about to commence improvements to its system here and at Chippewa Falls approximating $15,000. C.

HAVRE, MONT.—The Havre Electric Light and Telephone Company will shortly install two new switchboards, one for long distance and the other for farmers' lines. C.

PORTLAND, ORE.—E. C. Bradley of the Pacific Telegraph and Telephone Company announces that his corporation will spend $2,000,000 within the next year in improvements.

WORDEN, ILL.—The newly incorporated Worden Telephone Company has elected the following first board of directors; A. Z. Rice, F. W. Stoecker, S. P. Williamson, C. R. Wall and J. A. Stice. Z.

SAN JOSE, CAL.—The Co-operative Farmers' Telephone Line has asked for a right of way for a telephone line at Rucker to be operated on Monterey Road and Mastin, Rucker, Dennis and Foothill avenues.

RUDOLPH, WIS.—The Rudolph Telephone Company will build eleven miles of new lines and install twenty-six new telephones at once. Three new lines will go out from this place, one west to Sigel, one southwest and one northwest. M.

ALBION, ILL.—The Edwards County Mutual Telephone Company has elected the following officers; President, Fred Gill; vice-president, F. E. Albin; treasurer, O. A. Bunting and secretary Morris Colyer. In addition to these officers, directors are as follows; W. W. Blading, C. W. Leach, D. C. Bullard, S. C. Ring, P. J. Sifert and J. W. Hallam. Z.

QUINCY, CAL.—A franchise has been asked for for a telephone and telegraph line from this town northerly through the towns of Keddie, Indian Falls, Crescent Mills, Greenville and Prattville and on to the boundary line between Plumas and Lassen Counties with a short branch line from Crescent Mills through Taylorsville to Genesse Valley.

CHIPPEWA FALLS, WIS.—The Wisconsin Telephone Company has started work on improving its lines between this city and Eau Claire. The company will construct about 12,000 feet of additional overhead and underground cable. The exchanges at this place and at Eau Claire are to be enlarged and additional switchboards installed. The cost of the improvements will amount to $15,000. M.

ELECTRICAL SECURITIES.

The past week has in general been a week of liquidation. Considerable stock was sold at steadily declining prices and this, it seems, is a preparation for the strain on the money market which is expected in autumn. At that time the movement of crops and the requirement for funds thus involved might embarrass an overextended credit. As a futher issue Panama Canal expenditures bring up the question of possible withdrawal of government deposits from the banks or the issue of canal bonds as an alternative. The necessity is realized of a three per cent interest rate to float a bond issue, and refusal on the part of Congress to provide a higher tax on the bank note issues under these bonds as an offset against its profit compared with that under the two per cent bonds would cause a drop in the latter to below par in the market, it is claimed, thus calling for deposit of additional bonds to secure the circulation. The increased activity in the iron market at the reduced prices is regarded as giving promise of the expected turn towards betterment in that industry.

There has been listed on the Philadelphia Stock Exchange, $1,254,000 additional Rochester Railway and Light Company consolidated mortgage five per cent gold bonds.

The Bell Telephone Company has purchased the bond issue of the Interstate Independent Telephone and Telegraph Company, amounting to $2,300,000, for sixty per cent of the face value.

At the annual meeting of the American Telegraph and Cable Company, Edward J. Hall, Union N. Bethell, and B. Brooks were elected Directors, to succeed J. T. Terry, George J. Gould, and Edwin Gould. Other directors were re-elected.

James McKeen, general counsel for the Mutual Life Insurance Co., has been elected a director of the Brooklyn City Railroad Company, to fill the vacancy caused by the resignation of D. G. Leggett. The Mutual owns $1,200,000 of the Brooklyn Rapid Transit subsidiary's stock.

Authority has been given the Orange County Traction Company, by the New York Public Service Commission, to issue a $750,000 mortgage on its property and franchises, and to issue at once $233,800 of fifty-year five per cent bonds, at not less than eighty-five to take up outstanding indebtedness and provide for

improvements. The company may also use $425,000 for refunding.

Formal permission has been granted the Philadelphia Rapid Transit Company to place the stock of the Lehigh Avenue Street Railway Company, a subsidiary of the Union Traction Company, on a six per cent dividend basis, by the directors of the latter company. This is a utility measure so that the stock could be used as a part of the collateral upon which Philadelphia Rapid Transit proposes to borrow $2,500,000.

The Massachusetts Electric Company's received bids for the sale of 5,876 shares of Boston & Northern, and 4,034 shares of Old Colony Street Railway Company preferred stock, a total of 9,910 shares. The award was made to Curtis & Sanger and Estabrook & Company jointly. The stock is being offered for public subscription by the Curtis & Sanger syndicate at 123½, a 4.85 per cent income basis. The stock is tax exempt in Massachusetts.

E. R. Barnard, Philadelphia, is offering Mahoning & Shenango Railway and Light Company consolidated five per cent bonds at ninety-seven, yielding approximately five and five-eighths. The bonds are secured by a direct mortgage on all properties and by pledge of securities embracing $3,750,000 bonds and about all stocks of subsidiary companies. The system comprises 145 miles of electric railways between Pittsburg and Lake Erie. The consolidated bonds are authorized to an amount of $10,000,000.

The Philadelphia Transit Company will issue $1,500,000 ten-year five per cent equipment notes guaranteed by Union Traction. Drexel & Company have taken these notes and also car trust certificates for twenty new elevated cars amounting to $250,000. The new issue with the $600,000 of the collateral loan of December 15, 1908, now available will give the Philadelphia Rapid Transit between $3,500,000 and $4,000,000. The guarantee of the Union Traction Company must be given by the stockholders and the question will be submitted to them at the annual meeting in September.

DIVIDENDS.

Mackay Companies; common dividend of one and one-fourth, and preferred dividend of one per cent both quarterly, payable July 1.

Massachusetts Electric Companies; regular semiannual dividend of two per cent, payable July 1 to stock of record June 4. This dividend formally restores the $26,557,400 preferred to the full cumulative four per cent rate, and follows a semiannual dividend of one and three-fourth per cent or at the rate of three and one-half per cent paid on January 1 last.

New England Telephone and Telegraph Company; quarterly dividend of $1.50, payable June 30.

The Norfolk Railway and Light Company; regular semiannual dividend of two per cent, payable June 6 to stock of record at noon May 24.

Oklahoma Gas and Electric Company; common quarterly dividend of one and one-half per cent, payable June 15.

South Side Elevated; quarterly dividend of one and one-half per cent, payable June 30.

Twin City Rapid Transit Company; regular quarterly dividend of one and three-fourth per cent on the preferred stock, payable July 1 to stock of record June 17.

NEW YORK.	May 30	May 23
Allis-Chalmers common	9½	9½
Allis-Chalmers preferred	32	32
Amalgamated Copper	69⅝	72⅛
American Tel. & Cable	*80	*80
American Tel. & Tel.	136½	137
Brooklyn Rapid Transit	80¾	82⅛
General Electric	148½	150½
Interborough-Metropolitan common	20½	21¼
Interborough-Metropolitan preferred	54½	56½
Kings County Electric	124	124
Mackay Companies (Postal Telegraph and Cables) common	87¾	87½
Mackay Companies (Postal Telegraph and Cables) preferred	75½	75½
Manhattan Elevated	134	135
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
U. S. Steel common	82½	84½
U. S. Steel preferred	117¾	118½
Western Union	67¾	68
Westinghouse common	63¼	64¾
Westinghouse preferred	*110	110

*Last price quoted.

BOSTON.	May 30	May 23
American Tel. & Tel.	136½	137
Edison Elec. Illuminating	250	250
General Electric	148½	150½
Massachusetts Electric common	17½	17½
Massachusetts Electric preferred	85¾	85¾
New England Telephone	133½	134
Western Tel. & Tel. common	15½	15½
Western Tel. & Tel. preferred	88	87

PHILADELPHIA.	May 30	May 23
American Railways	45	44⅞
Electric Company of America	11¾	11⅞
Electric Storage Battery common	59	59½
Electric Storage Battery preferred	59	59½
Philadelphia Electric	15	15⅛
Philadelphia Rapid Transit	18	18⅛
Philadelphia Traction	85	86½
Union Traction	47½	47¾

CHICAGO.	May 30	May 23
Chicago Railways, Series 1	70	87
Chicago Railways, Series 2	17	28
Chicago Subway	2½	2¾
Chicago Telephone	116	115
Commonwealth Edison	112	113
Metropolitan Elevated Common	16	18
Metropolitan Elevated preferred	52½	57
National Carbon common	109	109
National Carbon preferred	118	116

PERSONAL MENTION.

WALTER DEARTH, formerly secretary of the Pana, Ill., Gas and Electric Light Company has been made manager to succeed C. E. Green.

J. M. BOSENBURY, superintendent of motive power and equipment for the Illinois Traction System has been transferred from Decatur, Ill., to Peoria.

A. A. ANDERSON, of Columbus, Ind., arrived in Springfield, Ill., June 1, to succeed Emil G. Schmidt as general manager of the utilities company in that city.

TOM L. PITTMAN, manager of the Citizens' Electric Company, of Lewiston, Mont., and Frank Gross, late manager of the electric light plant at Harlowton, Mont., will engage in the electric supply business at Lewistown.

J. W. ESTERLINE, Lafayette, Ind., has been appointed consulting engineer to design and supervise the erection of a new power station of the Crawfordsville Electric Light and Power Company of Crawfordsville, Ind.

J. P. PULLIAM, who has been assistant manager of the Eastern Wisconsin Electric Railway and Light Company and the Wisconsin Electric Railway Company, of Oshkosh, Wis., has received the appointment of general manager of the two companies.

BERNARD CORRIGAN, former president of the Metropolitan Street Railway company., of Kansas City, Mo., sailed from New York, June 1, on the steamer Mauretania. Mr. Corrigan expects to make a tour of Europe in order that he may rest, but he has no plans as to what he will do on arriving in England.

CECIL BROWN, a director in the London, Tilbury & South End Railway, arrived in New York last week. Mr. Brown is here for the first time and will make a study of the electric systems employed by various railways. Part of his road has already been electrified. Mr. Brown is a member of the British Institution of Civil Engineers.

M. ABRAHAMSON, of the firm of Tvermoes & Abrahamson, Copenhagen, Denmark, is now in New York city, with headquarters at the office of Melchoir, Armstrong & Dessan, 116 Broad street. The object of Mr. Abrahamson's visit in this country is to extend his connection with American manufacturers of electrical goods. His firm occupies a leading position among electrical engineers and dealers of electrical goods in Scandinavian countries.

OBITUARY.

WILLIAM A. HINDS, president of the Oneida Community, Ltd., died on May 28 at his home in Kenwood, N. Y. He was born at Belchertown, Mass., February 2, 1833, and was graduated from the Sheffield Scientific School in 1870.

ALFRED JOHN GREATHEAD, who has been connected with John A. Roebling's Sons Company for twenty-three years, and who has been secretary of the company for the past five years, died at his home 5645 Calumet Avenue, Chicago, on May 21, at the age of forty-nine. He was born on May 5, 1861, at Barnstaple, England. Mr. Greathead was a member of Kenwood Lodge 800, Ancient Free and Accepted Masons, Fairview Chapter 161, Royal Arch Masons, Montejoie Commandery, 53 Knights Templar. He leaves a widow and three daughters.

GEORGE F. BARKER, emeritus professor of physics in the University of Pennsylvania, died at his home in Philadelphia on May 24, in the seventy-fifth year of his age. Professor Barker had a very close association with the early developments in the electrical field in this country. He was United States Commissioner to the Electrical Exhibitions at Paris in 1881 and at Philadelphia in 1884, and a member of Jury of Awards at the World's Columbian Exposition at Chicago in 1893. In 1881 he was a delegate to the International Electrical Congress at Paris, and in 1894 he served on the committee which drew up the specifications for electrical units afterwards adopted by Congress and now constituting the legal units in this country. George Frederick Barker was born in Charlestown, Mass., and attended Yale University. He received the degree of Ph. B. in 1858, and M.D. at Albany in 1863, The honorary degrees of Sc. D. and LL.D. were conferred upon him by the University of Pennsylvania, Allegheny College and McGill University. He was assistant at Harvard and afterwards professor of chemistry at Yale and at Western University, and from 1873 to 1900 was professor of physics at University of Pennsylvania. Professor Barker was called in as an expert in the Edison, Berliner and other patent cases. He received the decoration of Commander of the French Legion of Honor, and at the time of his death was ranking officer of the Legion in the United States. He was the author of several text-books on chemistry and physics and a member of many learned societies both at home and abroad. These included the National Academy of Sciences, the American Association for the Advancement of Science, of which he was President in 1879, American Philosophical Society of which he was Vice-President, and the Royal Institution of Great Britain (honorary). He was also one of the editors of the American Journal of Science.

LEGAL NOTES.

USE OF WATER FOR POWER PLANT A BENEFICIAL ONE.—The United States circuit court of appeals, ninth circuit, says that in Thompson Company vs. Pennebaker, 173 Fed. R. 849, it was contended that a certain option to purchase water rights was void for the reason that the statute of the state of Washington authorizes the appropriation of water flowing in any river, stream, or ravine for irrigation, mining, or manufacturing purposes, but not for the "development and maintenance of an electrical power plant," mentioned in the agreement. But, as far as appeared from any record, the original appropriation was for a purpose strictly provided by statutes. After such appropriation had been made, the water could be applied to any beneficial use. The development and maintenance of an electric power plant is clearly a beneficial use. The option was, therefore, not open to the injunction that the appropriation was not within the statute.

DISCRIMINATION ALLOWED IN EMPLOYMENT OF ELECTRICIANS FATAL TO LAW.—The Louisiana act of 1908 providing for the licensing of master electricians in cities of 50,000 inhabitants, meaning New Orleans, provided that all electrical work, except work of minor importance, must be done under the supervision of a "master electrician," and excepted the lighting and electric railway companies and the department of police and public buildings of the city, which were exempted in so far as the maintenance and installation of their "equipment pole line services" and "meters" were concerned. The supreme court of Louisiana holds the law unconstitutional on account of the exceptions without good or reasonable cause making a discrimination in the application of the law. It says, State vs. Gantz, 50 So. R. 524, that if it be of importance to employ a master electrician, it is important that he be employed by the exempted and the nonexempted; and the law which relieves and exempts certain persons from the necessity of employing him is discriminative and repugnant to the fundamental law.

LIABILITY WHERE WIRES OF FOREIGN CORPORATION INJURE TREES ON SIDEWALK.—The supreme court of Texas holds, in Southwestern Telegraph and Telephone Company vs. Smithdeal, 124 S. W. R. 627, that the telephone company, which was a foreign corporation holding a permit from the state of Texas to construct and operate a telegraph and telephone line in Texas, was not exempted from the payment of damages caused to abutting property by the construction of its lines. The structure of the company was an additional burden upon the street. The telephone line may have been constructed by authority of law and with due care, yet, if its presence on the street caused or contributed to a depreciation of the "market value" of abutting property, the company was liable for such damages. The planitiff, a lot owner, had the right to grow trees upon the sidewalk, and if the trees were damaged by the telephone wires, which contributed to a depreciation of the market value of the property, such injury should be considered as if caused by the structure. This being an action for depreciation in the market value of the property, the injury to the trees could be considered only as it affected such market value.

NEW PUBLICATIONS.

THE EDISON ROUND TABLE.—The convention number of the Edison Round Table published by the Commonwealth Edison Branch of the National Electric Light Association, contains an interesting and humorous report of the affairs at the St. Louis convention. The publication is profusely illustrated with cartoons of men prominent at the convention.

FIRES: EFFECT ON BUILDING MATERIAL AND PERMANENT ELIMINATION.—Under this title, Frank B. Gilbreth presented before the American Society of Mechanical Engineers, a paper dealing principally with concrete buildings. Concrete is from every standpoint cheaper than wood, and is the best form of construction for the elimination of fires. A concrete wall makes an ideal fire barrier and the spread of flames is only possible openings, such as doorways windows etc. A number of illustrations given in the paper show the effects of fire on several buildings.

A STUDY IN HEAT TRANSMISSION.—Under this title, bulletin No. 40, by J. K. Clement and C. M. Garland, is issued by the engineering experiment station of the University of Illinois. This bulletin is for the technical reader and will be of interest to the student and physicist as well as the designer and operator of heating or cooling apparatus of any description. The results of the experiments apply directly to the problem of increased effectiveness of heating or cooling surfaces, which is a problem at the present moment engaging the attention of engineers. A large portion of the interest in the bulletin lies in the method of experimentation. The results show that the heat transmitted through the walls of a vessel in contact with water may be increased two or three times by increasing the velocity or rate of agitation of the water.

PROPOSALS.

POSTOFFICE, COLUMBUS, IND.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until June 20, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States postoffice at Columbus, Ind., in accordance with drawings and specifications, copies of which may ge obtained from the custodian at Columbus, Ind., or at the Supervising Architect's office.

POST OFFICE, AIKEN, S. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until June 24, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Aiken, S. C., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Aiken, S. C. or at the Supervising Architect's office.

POST OFFICE, CLINTON, MO.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until June 23 for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Clinton, Mo., in accordance with the drawings and specifications, copies of which may be obtained from the custodian of site at Clinton, Mo., or at the Supervising Architect's office.

POST OFFICE, PLATTSMOUTH, NEB.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until June 28 for the construction, complete (including plumbing, gas piping, heating apparatus and electric conduits and wiring of the United States Post Office at Plattsmouth, Neb., in accordance with drawings and specifications, copies of which may be obtained from the custodian at Plattsmouth, Neb., or at the Supervising Architect's office.

POST OFFICE, CHAMBERSBURG, PA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until June 29, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Chambersburg, Pa., in accordance with drawings and specification, copies of which may be obtained from the custodian at Chambersburg, Pa., or at the Supervising Architect's office.

NEW INCORPORATIONS.

CLYDE, KAN.—The Laughlin Secret Call Telephone Company has been incorporated with a capital of $100,000 to manufacture telephones, etc.

ALBANY, N. Y.—The Dulles-Baldwin Electric Drill Company has been incorporated with a capital of $600,000 to manufacture and deal in drilling machinery. The incorporators are: J. H. Baldwin, F. P. Darte, E. T. Magoffin, New York City.

BROOKLYN, N. Y.—The Universal Standard Electric Company has been incorporated to manufacture and deal in electrical machinery and applicances of all kinds, with a capital of $50,000. The incorporators are: J. J,. Nevins, W. H. Hobart, A. Schrieber, Brooklyn.

BIRMINGHAM, ALA.—The Electric Revolving Sign Company which was recently chartered, has organized with $5,000 stock to manufacture electric signs and advertising appliances, electing A. L. Campbell, president, Pat Shannon, vice-president, J. T. Moncrief, secretary and T. T. Dixon, treasurer.

BUTLER, IND.—Articles of incorporation have been filed with the Secretary of State by the Trebest Gas Engine Company. The company is capitalized at $20,000. The company will manufacture gas engines and other electric light plant equipment. H. M. Showalter is president and D. A. Baker secretary.

NEW YORK, N. Y.—The Universal Wireless Telegraph Supply Company has been incorporated to manufacture and deal in telephone and telegraph supplies, and manage a wireless telegraph business, with $100,000 capital. The incorporators are: Bernard I. Kamen, M. G. Bender, David C. Munson, of New York city.

INDUSTRIAL ITEMS.

THE ROME WIRE COMPANY, Rome, N. Y., has sent out its monthly post-card for June, advertising Romeoid magnet wire and annunciator wire. The card is imprinted with an attractive picture.

THE DUPLEX METALS COMPANY, Singer Building, New York, N. Y., is sending out a novel blotter, advertising copper-clad steel wire. The company's weld clad trademark is imprinted on the blotter.

THE H. W. JOHNS-MANVILLE COMPANY, Cleveland, Ohio, announces in its May issue of The J. M. Packing Expert, that with this number the publication will be issued every month. An interesting account is given of tests which were conducted on samples of J. M. Permanite.

THE PETTINGELL-ANDREWS COMPANY, Boston, Mass., calls attention in its May issue of *Juice* to the novel design of its cover. The cover shows an automobile containing Mr. Boynton and the editor of *Juice*. The rest of the design is taken from the company's catalogue of automobile sundries.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has mailed its June number of Trumbull Cheer to the electrical trade. The number contains illustrations of one-piece moulding receptacle, moulding branch block, and Trumbull new rosettes which are designated as "Three Big Successes."

THE KUHLMAN ELECTRIC COMPANY, of Elkhart, Ind., has just published a circular relative to its new line of three-phase

transformers. These are now being built in sizes from five to 100 kilowatts and are supplying a marked demand for a compact, more efficient and more economical transformer than is attainable by banking three single-phase units. Copies of this circular, which describes these transformers in detail, are obtainable on request to the company.

THE ENGINEERING ELECTRIC MANUFACTURING COMPANY, Stamford, Conn., describes in bulletin No. 108, its Stamford electric-clock and program system for schools, colleges, public buildings, etc. Several illustrations give an idea of the general appearance of the master clock and the secondary clocks used in this system, and a number of advantages are set forth. Aside from the standard forms, there are especially designed clocks for use where such are desired.

THE DEARBORN DRUG AND CHEMICAL WORKS, Chicago, Ill., has sent out attractive folders announcing that their general offices and laboratories are now located in new quarters on the twentieth floor of the McCormick Building, on Michigan Avenue and Van Buren Street. These new headquarters for the executive and chemical departments together with the manufacturing plant and various selling branches especially equip the company for the business of treating boiler feed waters.

THE RELIANCE ELECTRIC AND ENGINEERING COMPANY, Cleveland, O., announces that its new type of variable-speed motor will be known as the Reliance adjustable-speed motor, instead of the Lincoln variable-speed motor as formerly. This change is made necessary to describe better this type of motor in accordance with present standard terms adopted by the American Association of Electric Motor Manufacturers, and also to avoid confusion with the Lincoln Electric Company of Cleveland.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., in its May number of *Hot Points*, makes an especial feature of "Hot Point Day," which is to be June 10. This date marks the opening of the company's national advertising campaign for 1910. Circulars sent out to jobbers urge them to boost their business by means of street-car and newspaper advertisements. On June 4 the company is to publish a full-page advertisement in the *Saturday Evening Post*, a copy of which advertisement is sent with May *Hot Points*.

THE TRIUMPH ELECTRIC COMPANY, of Cincinnati, Ohio, reports the following sales within the past three weeks: One 200 kilowatt alternating-current engine-type generator, 200 revolutions per minute; also thirty alternating-current motors aggregating 450 horsepower, to Geo. Belcher, Stoughton, Mass; one 300 kilowatt direct-current engine-type generator, 200 revolutions per minute, to The Oakley Colony Power Company, Oakley, Ohio; one 150 kilowatt direct-current engine-type generator, 200 revolutions per minute, also several motors, to The Regal Motor Car Company, Detroit, Mich.; one 150 kilowatt direct-current engine-type generator, 200 revolutions per minute, to The Edwards Manufacturing Company, Cincinnati, Ohio; one 100 kilowatt direct-current engine-type generator, 250 revolutions per minute, to The Chas. Boldt Co., Cincinnati, O.; one 100 kilowatt direct-current engine-type generator, 250 revolutions per minute, to The Schacht Manufacturing Company, Winton Place, O.; one 100 kilowatt direct-current engine-type generator, 250 revolutions per minute, and two sixty kilowatt direct-current engine-type generators, 250 revolutions per minute, to The E. A. Kinsey Company, Cincinnati, Ohio; three seventy-five kilowatt direct-current engine-type generators, 275 revolutions per minute, to The Northwestern Electrical Equipment Company, St. Paul, Minn.; one seventy-five kilowatt direct-current engine-type generator, 275 revolutions per minute, to The Grabowsky Power Wagon Company, Detroit, Mich.; one seventy-five kilowatt direct-current engine-type generator, 275 revolutions per minute, to McGill Warner & Company, St. Paul, Minn., also a balancer set; two seventy-five kilowatt direct-current engine-type generators, 275 revolutions per minute, to The Mechanic Arts High School, St. Paul, Minn.; one sixty kilowatt direct-current engine-type generator, 250 revolutions per minute, to The Cincinnati Ball Crank Company, Cincinnati, Ohio; one sixty kilowatt direct-current engine-type generator, 250 revolutions per minute, to The Ficks Carriage & Reed Co., Cincinnati, Ohio.; one 50 kilowatt direct-current engine-type generator, 200 revolutions per minute, to the V. D. Anderson Company, Cleveland, Ohio; one fifty kilowatt direct-current engine-type generator, 290 revolutions per minute, to The Haehnle Provision Company, Covington, Ky.; two fifty kilowatt engine-type direct-current generators, 290 revolutions per minute, and switchboard, to The Cincinnati City Hospital; one 50 kilowatt direct-current engine-type generator, 290 revolutions per minute, to The Cape Brewing Company, Cape Giradean, Miss.; one fifty kilowatt direct-current engine-type generator, 290 revolutions per minute, to The Philadelphia Brewing Company, Philadelphia, Pa.; one thirty-five kilowatt direct-current engine-type generator, 310 revolutions per minute, to The South Western Hospital, Marion, Va.; seven alternating-current motors to Consolidated Expanded Metal Company; twenty direct-current motors to Cincinnati Milling Machine Company; eight direct-current motors aggregating sixty horsepower to the University of Cincinnati. This is a good indication of the rapidly improving business conditions. The Triumph Electric Company also reports that the increased facilities in its new shops enable the company to handle this large amount of business with great promptitude.

DATES AHEAD.

National Electrical Trades Association. Next meeting, San Francisco, Cal., June, 1910.

Mississippi Electric Association. Annual convention, Greenville, Miss., June 15 and 16.

American Society of Civil Engineers. Annual convention, Chicago, Ill., June 21-24.

American Institute of Chemical Engineers. Semi-annual meeting, Niagara Falls, N. Y., June 22-24.

Society for the Promotion of Engineering Education. Annual meeting, Madison, Wis., June 23-25.

American Institute of Electrical Engineers. Annual convention, Waumbeck Hotel, Jefferson, N. H., June 27, 28, 29 and 30.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 28-July 2.

American Society of Heating and Ventilating Engineers. Semi-annual meeting, St. Louis, Mo., June 30-July 1.

Michigan Electrical Association. Annual convention, Port Huron, Mich., August 16, 17 and 18.

League of American Municipalities. Annual convention, St. Paul, Minn., August 23-26.

Pacific Coast Exposition. San Francisco, Cal. August 20 to August 27, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) May 24, 1910.

958,719. SIGNAL-BOX FOR FIRE-ALARM SYSTEMS. Frederick S. Bronson, Rochester, N. Y., assignor to Denio General Electric Company, Rochester, N. Y. Filed Dec. 13, 1909. A signal mechanism for use on subscribers' circuits of automatic telephone exchange systems.

958,727. CLUSTER LAMP-SOCKET. John H. Dale, New York, N. Y. Filed May 6, 1908. A terminal clip is threaded on a metal ring of L-shaped section which engages the lamp-receiving shell, this latter being received in an insulating cup. A screw, on which is threaded a terminal clip, constitutes the center contact.

958,728. CLUSTER LAMP-SOCKET. John H. Dale, New York, N. Y. Filed May 6, 1908. Included between the parts of a two-part insulating ring are shells for supporting lamp-receiving shells and establishing circuit connections therewith.

958,729. CLUSTER LAMP-SOCKET. John H. Dale, New York, N. Y. Filed May 6 1908. A cluster socket comprises an insulating ring, threaded shells having loops or straps surrounding this ring and securing the shells thereto, and means affording center contacts.

958,731. COMBINED PIANO-PLAYER AND TALKING-MACHINE. Walter M. Davis, New York, N. Y. Filed Sept. 10, 1909. In combination with a piano-playing machanism are a music roll, a motor, a clutch, an electromagnet for operating the clutch, an electric circuit, a talking machine, and means for closing the electric circuit by means of the talking machine disk and stylus.

958,744. TROLLEY-WHEEL HOLDER AND GUIDE. William A. Gunn and Lewis W. Link, Cincinnati, Ohio. Filed Sept. 10, 1908. A frame with rotatable side pieces.

958,753. ELECTRIC CAUTERY. William Meyer, Chicago, Ill. Filed Sept. 13, 1909. An electric cautery comprises two leads of unequal length, insulated from each other but rigidly united together, a cauterizing conductor connecting the unequal ends of these leads, and a hard coating of japan, of suitable thickness applied to the reach of the longer lead opposite the conductor.

958,754. HIGH-FREQUENCY MAGNETO. Theodore M. Mueller, New York, N. Y. Filed Aug. 4, 1908. Comprises a permanent magnet provided with poles, a magnetic member provided with poles and spaced apart from the permanent magnet, an inductor having a portion adapted to pass successively all of the poles, and a core disposed intermediate the magnet poles and also intermediate the poles of magnetic material.

958,755. PUSH-BUTTON SWITCH. Adolph S. Muller and Leo E. Carrico, Denver, Colo. Filed May 17, 1909. Operates with a rachet and cam mechanism.

958,757. ELECTRIC MELTING AND REFINING FURNACE. Hans Nathusius, Friedenshütte, near Morgenroth, Germany. Filed

May 7, 1908. The heat is controlled by effecting a varying distribution of current flow between various electrodes.

958,788. MAGNETIC SWITCH. James J. Wood, Fort Wayne, Ind. Filed Sept. 29, 1905. Movable contacts are electromagnetically operated, etc.

958,792. ELECTRICAL MEASURING INSTRUMENT. John L. Zander, Newark, N. J. Filed May 21, 1909. Two horseshoe magnets side by side in the same plane have the ends of their adjacent legs (which are of like polarity) curved in arcs of the same circle, the curved ends being concentric with the concave faces of a pair of blocks secured to the respective straight outer legs of the magnets. Each curved leg of the magnets is embraced by a wire-wound coil, the coils being carried at the ends of a spindle secured at the center of the circular arcs.

958,803. CONTROLLER. Fletcher D. Hallock, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed Sept. 8, 1908. Stationary contact terminals are arranged in the arc of a circle; a movable arm has a contact terminal to engage successively the stationary terminals; a notched spring-retracted member is operatively connected to the movable arm; electro-responsive means for locking this member permit independent movement of the arm in one direction; and means carried by the arm accentuate positions in the independent adjustment of the arm.

958,804. MOTOR-STARTER. Fletcher D. Hallock, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed Jan. 3, 1910. A controller comprises a plurality of stationary contact members insulated from each other and arranged in an arc of a circle, a movable contact arm adapted to sweep over the stationary members, an operating handle lever independently pivoted upon the same axis as the contact arm, a spring tending to cause the arms to operate together, and means, dependent upon predetermined conditions in the circuit governed by the controller, for locking the two arms together.

958,805. RHEOSTATIC CONTROLLER FOR ELECTRIC MOTORS. Fletcher D. Hallock, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed Jan. 3, 1910. A controller for electric motors comprises a pair of resistance-regulating arms adapted to operate together in one direction, a retracting spring tending to throw one of the arms to its off position, an electromagnet acting in opposition to the retracting spring for holding the arm in the operating positions of the controller, and a switch carried by the other arm for controlling the circuit of the magnet.

958,806. REGULATING-RHEOSTAT. Fletcher D. Hallock, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed Jan 3, 1910. A controller for electric motors comprises a pair of contact-bearing arms one of which is adapted successively to short-circuit the motor field and the motor armature resistance as it progresses in one direction and the other of which is adapted gradually to exclude the armature resistance as it progresses in one direction and to gradually interpose the field resistance as it progrosses in the opposite direction.

958,808. FUSED DISTRIBUTING-BOARD AND CROSS-CONNECTING RACK. Robert G. Hardgrave, Tucumcari, N. Mex. Filed May 3, 1909. A distributing board has street-cable connections on one side and switchboard-cable connections on the opposite side, the sides being the front and rear of the board and interchangeable jumper wires extending between the connections.

958,827. ELECTRIC-ARC LAMP. Leon W. Pullen, Camden, N. J., assignor to Waldron Clark Manufacturing Company. Filed Dec. 12, 1905. The arc lamp comprises a head consisting of a series of superimposed flanged plates of different diameters in which the flanges form two annular deep concentric grooves each containing a sealing body of mercury, a tubular central part for uniting the several flanged plates, a central closed globe having its lower rim fitted into the inner of the grooves, an outer inclosing globe surrounding the inner globe and having its lower rim fitted into the outer of the grooves, clamps for electrodes within the inner globe, and electromagnetic means for adjusting the electrodes to maintain an arc.

958,828. ARC-LAMP. Leon W. Pullen, Camden, N. J., assignor to Waldron Clark Manufacturing Company. Filed May 24, 1906. Includes a frame structure consisting of the combination of a central tubular part open at the bottom, a lower head surrounding the lower end of the tube and supported thereby, a cylindrical case of larger diameter than the tube and resting upon the lower head, an upper head resting upon the top of the cylindrical case, a second cylindrical case resting upon the upper head, a cap resting upon the top of the second cylindrical case, and a bolt for drawing the cap and central tubular part toward each other for clamping the several parts together.

958,829. METHOD AND APPARATUS FOR PRODUCING HIGH-FREQUENCY OSCILLATING CURRENTS. James H. Rogers, Hyattsville, Md. Filed Jan. 20, 1910. The method of producing high-frequency oscillating currents consists in regulating the discharges of a condenser between two electrodes by continuously feeding a small body of liquid of relatively low conductivity, in liquid form, between the electrodes to produce an unbalanced condition of conductivity and resistance.

958,833. TROLLEY-CONDUCTOR CLAMP. William Schaake, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed Nov. 19, 1908. A clamp comprises a pair of duplicate members having oppositely projecting shanks and jaws and intermediate interlocking fulcrum parts, and means located between the shanks to exert a separating force whereby the jaws are moved toward each other.

958,834. HANGER FOR ELECTRICAL CONDUCTORS. William Schaake, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed July 28, 1909. A clamp comprises two complementary gripping members having outwardly projecting complementary bosses provided with inclined surfaces, caps for the bosses and a bolt for drawing the caps toward each other.

958,835. WIRE BAR FOR IGNITION SYSTEMS. Charles Schmidt, Cleveland, Ohio, assignor to The Peerless Motor Car Company, Cleveland, Ohio. Filed Nov. 18, 1907. In an ignition system for explosive engines, having a plurality of cylinders, a wire bar of insulating material located adjacent to the cylinders of the engine, has several high-tension wires for the cylinders and connecting terminals therefor embedded therein, each high-tension wire leading from a connecting terminal for the current source at its one end to a connecting terminal for a cylinder at its other end.

958,846. ELECTRICAL WATER-HEATER. Hiram D. Wood, Jr., Minneapolis, Minn. Filed April 8, 1909. A coiled electrical conductor is located within and extends longitudinally along a water-delivery conduit, with imperforated walls and open ends, adapted to be opened from end to end by the separation of the sections of a two-part member.

958,847. PARTY-LINE-TELEPHONE CALL MECHANISM. William E. Zabst, Portage, Wis. Filed April 21, 1909. A motor-operated signal device.

958,855. ELECTRIC FURNACE. Harold A. Danne, Clarkesburg, W. Va. Filed Jan. 15, 1910. An electric furnace comprises a circular electrode increasing in diameter downwardly, and a plurality of annularly disposed groups of electrodes surrounding the first-named electrode, each group being disposed in a different horizontal plane.

958,856. TELEPHONE SYSTEM. William W. Dean, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Filed Oct. 14, 1909. A high resistance, normally preventing the operation of a supervisory relay in the central-station circuit, may be eliminated when a called subscriber responds.

958,863. PARTY-LINE CALL-REGISTER FOR AUTOMATIC TELEPHONE SYSTEMS. Alfred H. Dyson, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company. Filed June 20, 1908. A register for party lines includes a device connected with a line adapted for adjustment to indicate that one of a purality of stations on the line initiating a call, and means subsequently beyond the control of the calling party for recording the indications of the device.

958,868. TELEPHONE SYSTEM. William F. Gradolph, St. Louis, Mo., and William C. Hahne, Chicago, Ill., assignors to Gradolph Electric Company, St. Louis, Mo. Original application filed Dec. 20, 1905. Divided and this application filed Feb. 1, 1908. There are means at each station for impeding the current in one side of the circuit, and also means for cutting out the impeding means.

958,869. RHEOSTAT. Fletcher D. Hallock, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed July 6, 1908. A rheostat for short-circuiting field and armature resistances of a dynamo-electric machine.

958,870. STARTING-RHEOSTAT. Fletcher D. Hallock, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed July 6, 1908. Includes a feature to interrupt operative connection upon the occurrence of abnormal circuit conditions.

958,894. PARTY-LINE TELEPHONE SYSTEM. Homer J. Roberts, Evanston, Ill., assignor to Homer Roberts Telephone Co. Filed May 1, 1905. Besides a main line extending uninterruptedly through a series of substations there is a sectional main line comprising a series of normally disconnected sections, each section of which extends from the station of its origination to a succeeding station and is there normally connected to the intact main line. Means operable from the central station are provided for progressively disconnecting each section from the intact main line and connecting it to a succeeding section, and electrically actuated means at each substation establish a circuit through the talking coil and between the two main lines.

958,899. SPARK-COIL. Chester H. Thordarson, Chicago, Ill. Filed Sept. 3, 1907. A spark coil has a core and a subdivided side part formed with pole faces presented toward but separated

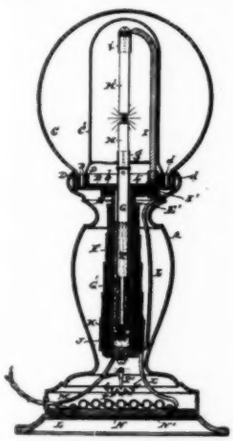
from the ends of the core, and channel plates engaging the ends of the core and side part to hold the same in assembled relation.

958,906. EAR FOR TROLLEY-WIRES. James H. Callender. Brooklyn, N. Y., assignor to F. H. Lovell & Company, Arlington, N. J. Filed June 14, 1907. Renewed March 25, 1910. The flanges of the groove may be bent over completely to envelop the wire.

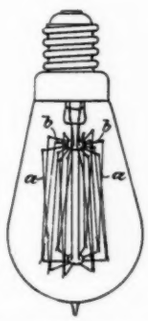
958,925. TELEPHONE SET. William Kaisling, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company. Filed Aug. 1, 1908. A telephone set includes a back plate, a hinged containing box supported thereby, an impulse controlling device, a slidably removable cover for the box supporting the device and a catch for locking the cover in adjusted position.

958,939. MASSAGE APPARATUS. George R. Pyper, Salt Lake City, Utah. Filed July 15, 1909. A massage device comprises a casing, a motor supported in the casing, an arm connected to the motor and having apertures eccentric to the shaft of the motor, a vibrating shaft, a massage device connected to the vibrating shaft, and a tensioned spiral spring surrounding the vibrating shaft and adapted to prevent the disengagement of the shaft from the apertures in the arm and to prevent the rotation of the shaft.

958,979. TELEPHONE SWITCH-HOOK. Burton W. Sweet, Cleveland, Ohio, assignors to Harry Z. Sands, Cleveland, Ohio. Original application filed April 1, 1907. Divided and this application filed September 20, 1909. In combination with a pivoted actuating part, are switch springs connected to be moved into and out of electrical engagement thereby a removable supporting member detachably fitting the actuating



958,827.—ELECTRIC ARC LAMP.



959,075.—METAL FILAMENT LAMP.

part, and a resilient or spring actuated detent adapted removably to hold the parts normally in operative relation.

958,988. PULL-SOCKET FOR ELECTRIC SWITCHES. Frederic W. Barr, New York, N. Y. Filed Nov. 12, 1909. Switch segments are electrically connected by the pull cord.

959,005. REGULATING-RHEOSTAT FOR ELECTRIC MOTORS. Fletcher D. Hallock, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed Jan. 3, 1910. A rheostatic controller for electric motors comprises field and armature contact members, a pair of contact-bearing arms and adjustable means for restricting the independent adjustment of one of the arms relative to the other.

959,032. ELECTRICAL SELF-PLAYING ATTACHMENT FOR PIANOS. Irving B. Smith, Philadelphia, Pa., assignor to Electrelle Company, Philadelphia, Pa. Filed May 19, 1905. Includes electrically controlled shoe and roller-actuating mechanism, etc.

959,052. INSULATOR AND CONDUCTOR FOR ELECTRIC CURRENTS. Albert Champion, Flint, Mich., assignor to Champion Ignition Company, Flint, Mich. Filed Nov. 3, 1908. A tube of insulating material has conductors embedded in its wall and is inclosed in a casing. A conductor extends through the tube.

959,064. CABLE-HANGER. Fredric D. Ogden, Bayonne, N. J. Filed Jan. 27, 1910. A cable hanger comprises a cable-supporting loop and two terminal portions constituting hooks, one of the terminal portions being provided with a guard for co-engagement with the hook upon the other portion.

959,075. METAL-FILAMENT LAMP. Carl Rumenapp, Augsburg, Germany. Filed March 20, 1909. A metal-filament lamp is characterized by the arrangement of alternately long and short current distribution wires.

959,076. TROLLEY-WIRE HANGER. John T. Scanlon, Hartford, Conn. Filed Sept. 30, 1909. A trolley-wire hanger includes a body part having means for attachment to a support, jaws projecting from the edge of the body part forming a throat to receive a wire, and lips integrally formed on the body part and projecting from its lower edge laterally in opposite directions forming recesses opening in opposite directions and laterally of the direction of opening of the throat.

959,100. AERIAL CONDUCTOR ARRANGEMENT FOR WIRELESS TELEGRAPHY. Georg von Arco, Berlin, Germany. Filed Nov. 1, 1906. An aerial conductor system for wireless telegraphy consists of a central electrically conducting support insulated from the ground and an umbrella-shaped group of wires running obliquely toward the ground, the wires being at one end electrically connected with the support and at the other end fixed to several distant points on the ground and insulated therefrom.

959,120. LIGHTNING-ARRESTER. William W. Dean, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Filed April 26, 1909. Two sheets of finely divided conducting material are separated by an insulator.

959,132. WEFT-REPLENISHING LOOM. Albert A. Gordon, Jr., Worcester, Mass., assignor to Crompton & Knowles Loom Works. Filed Dec. 17, 1908. A filling detecting mechanism comprises a solenoid, a magnetized feeler mounted in the solenoid, and a two-armed lever operated by a moving arm or lever to move the feeler forward at stated intervals.

959,133. ARC-LAMP ELECTRODE. Josef H. Hallberg, New York, N. Y., assignor to The Beck Flaming Lamp Company, Canton, N. Y. Filed April 26, 1907. A carbon electrode for arc lamps comprises a body of carbon, a core, a radially projecting external rib and a longitudinal metallic conductor embedded in the rib.

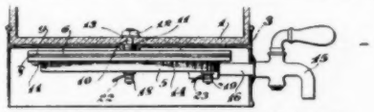
959,155. DEVICE FOR CATCHING FLIES AND OTHER INSECTS. John Nault, Chicago Heights, Ill. Filed June 12, 1909. The insects are attracted by an electric light to the coned mouth of a tube into which they are drawn by the suction of an electric fan and thence forced into a trap.

959,166. MAGNETO-ELECTRICAL GENERATOR. Benjamin P. Remy and Frank I. Remy, Anderson, Ind., assignors to Remy Electric Company, Anderson, Ind. Filed March 3, 1909. A magneto-electric ignition apparatus.

959,171. ELECTRIC-CIRCUIT BREAKER. William Harding Scott, Norwich, England. Filed December 23, 1907. A relay circuit breaker.

959,192. STORAGE BATTERY. Vincent G. Apple, Dayton, Ohio. Filed December 21, 1908. Two plate-grid electrodes comprise a series of tapered ribs crossing at angles to form tapered cells for the reception of active material.

959,194. ANNUNCIATOR-DROP. Charles Auth, New York, N. Y. Filed March 5, 1909. Comprises an electromagnet, a core there-



958,846.—ELECTRICAL WATER HEATER.

for, an armature movable at one end, and an adjustable plate engaging and limiting the movement of the movable end of the armature.

959,197. OVERHEAD CONTACT SYSTEM FOR ELECTRIC RAILWAYS. Julius Belzner, Jr., Mount Vernon, N. Y. Filed January 5, 1909. An overhead contact-system for electric railways.

959,205. REFLECTOR ATTACHMENT. Henry D'Olier, Jr., Rutherford, N. J. Filed October 7, 1908. A reflector or shade attachment comprises a resilient ring member, a bead thereon, a reinforcing ring secured by the ring member on one side of the bead, a second bead, a lip or flange, and a groove formed between the second bead and the lip or flange.

959,206. REFLECTOR ATTACHMENT. Henry D'Olier, Jr., Rutherford, N. J. Filed October 7, 1908. Means for longitudinally adjusting the reflector or shade comprise two adjuster members supported one upon the other, the shade or reflector being secured upon one of the adjuster members, and a projection and groove connection between the adjuster members, permitting the members to telescope one upon the other.

959,215. ELECTRIC HEATING DEVICE. Robert L. Hailey, New York, N. Y., assignor to The Lowe Electric Company, New York, N. Y. Filed March 9, 1909. An electric iron has a radiating plate and a zigzag resistance element.

959,243. DESK-TELEPHONE STANDARD. Charles T. Mason, Sumter, S. C., assignor to The Sumter Telephone Mfg. Co., Sumter, S. C. Filed October 20, 1909. A one-piece desk-stand casing has a transmitter supported thereon, the casing having an opening for the insertion of a unit switch hook mechanism, and means for supporting the hook mechanism allow of its removal without disturbing the transmitter connections.

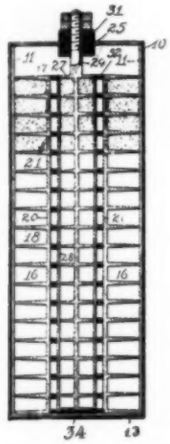
959,248. ELECTRIC SWITCH. James F. McElroy, Albany, N. Y., assignor to Consolidated Car Heating Company. Filed September 16, 1909. An electric switch comprises a pivotally

mounted spring-pressed switch block, a push rod pivotally connected to the block, a depressible locking member, and means for operating the same. The switch block is arranged to pass over the locking member when the same is depressed, whereby the locking member is operated when the switch block is actuated by its push rod.

959,257. ELECTRICALLY-ACTUATED SWITCH. Frederick G. Proutt, Memphis, Tenn. Original application filed September 13, 1904. Divided and this application filed November 30, 1908. An electrically operated switch comprises a switch blade pivoted below its center of gravity and provided with an arcuate slot above the point at which it is pivoted, a solenoid, and a core actuated by the solenoid and working in the slot.

959,303. INSULATOR FOR BATTERY-PLATES. Cyrus J. Bristol, Des Moines, Iowa. Filed September 27, 1909. A bar having notches at one edge is designed to be extended through openings in the battery plate, and to admit the adjacent portions of the battery plates in the notches thereof, and a locking strip is designed to be extended through the openings in the battery plates to engage the edge of the bar opposite from the notches.

959,305. ELECTRIC WELDING-MACHINE. Alvin E. Buchenberg, Toledo, Ohio, assignor to The Toledo Electric Welder Company, Toledo, Ohio. Filed September 25, 1909. A current-conducting member movable toward and away from the work-holder has a socket in its inner end; a work-holder is removably carried within this socket; and means are provided for moving the member.



959,192.—STORAGE BATTERY.

959,331. STEREOSCOPE. Albert Edward Foote, Berlin, Germany. Filed May 11, 1908. A stereoscope has contacts on the handle, a source of electricity in the handle, a switch carried by the handle, a push button projecting from the handle and adapted to operate the switch, conductors of electricity in the stereoscope, an electric lamp connected to said conductors, and contacts adapted to be engaged by the contacts on the handle.

959,337. TRANSMISSION OF ELECTRICAL ENERGY. William F. F. Gradolph, St. Louis, Mo., and William C. Hahne, Chicago, Ill., assignors to Gradolph Electric Company, St. Louis, Mo. Filed December 20, 1905. The system comprises a source of alternating currents, a metallic circuit the lines of which are in inductive relation to each other, an impedance device located in one of the lines, and a surging line in inductive relation to both of the lines, the impedance and surging line co-operating to alter the normal phase relation of the current in one line relative to that in the other.

959,370. STATION-INDICATOR. Christopher Messing, New York, N. Y. Filed August 21, 1909. In combination with a rotatable member are display cards secured to the member, electrical means for rotating the member, manual means for rotating the member, and means for forcing said manual means into operative connection with the member.

959,371. ELECTRIC SIGN. Leonard Miller, Brownwood, Tex., assignor of one-half to Boy Stephanus Boysen, Brownwood, Tex. Filed January 18, 1909. An automatic sign flasher.

959,399. ELECTRIC HEATER. George E. Stevens, Lynn, Mass., assignor to General Electric Company, a corporation of New York. Filed September 25, 1908. A water heater comprises a heating element in the path of water flow, and a normally open circuit-closer responsive to water flowing over the heating element to close the circuit through the heating element.

959,409. BRACKET FOR TELEPHONE RECEIVERS. Hugo P. Voss, New York, N. Y. Filed November 22, 1909. An extension-arm device.

959,428. METHOD OF TRANSMITTING ELECTRICAL ENERGY. William F. Gradolph, St. Louis, Mo., and William C. Hahne, Chicago, Ill., assignors to Gradolph Electric Company, St. Louis, Mo. Original application filed December 20, 1905. Divided and this application filed April 7, 1910. The method consists in generating an alternating current and delivering it to a circuit, altering adjacent to the generator end of the circuit the normal phase relations of the currents in the two sides of the circuit, and finally restoring the normal phase relations of the currents in the two sides of the circuit near the receiving end of the circuit before delivering them to translating apparatus.

959,435. CIRCUIT-CLOSER. Henry C. Thomson, Boston, Mass., assignor to Electric Goods Manufacturing Company. Filed March 6, 1909. Diametral expansion of a resilient conducting ring by means operated by a plunger renders the ring effective as a conductor between contact members.

959,440. ELECTRICAL SIGN. Harry I. Blits, Clearfield, Pa. Filed August 1, 1908. Comprises a housing, a door arranged in the housing, a clock-operated switch mounted on the door (the door being pivotally mounted for permitting free access to the clock mechanism), a plurality of translucent advertising panels, a border surrounding the panels, and means for illuminating the panels and the border, this means being adapted to be turned on and off by the clock-operated switch.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired May 30, 1910:

498,236. TELEPHONE SYSTEM. Emery A. Clark, Sioux City, Ia.

498,243. TELEPHONE SWITCH. Augustus G. Davis, Baltimore, Md.

498,269. ELECTRIC-ARC LAMP. Louis Hills, New York, N. Y.

498,289. ELECTRICAL SIGNALING SYSTEM. Alfred S. McCaskey, Chicago, Ill.

498,290. RAILWAY BLOCK-SIGNALING SYSTEM. Alfred S. McCaskey, Chicago, Ill.

498,291. AUTOMATIC TELEPHONE EXCHANGE SYSTEM. Alfred S. McCaskey, Chicago, Ill.

498,309. TELEPHONE-TRANSMITTER. Charles F. Scattergood, Albany, N. Y.

498,312. ELECTRIC LIGHTING SYSTEM. Charles E. Scribner, Chicago, Ill.

498,327. POLE PIECE FOR DYNAMO-ELECTRIC MACHINES. Elihu Thomson, Swampscott, Mass.

498,372. ELECTRIC REGISTERING DEVICE. Barton B. Ward, New York, N. Y.

498,387. ELECTRIC ARC LAMP. Frederick D'A. Goold, New York, N. Y.

498,403. ELECTRIC-RAILWAY TROLLEY. Patrick F. O'Shaughnessy, New York, N. Y.

498,422. GALVANIC BATTERY. William Burnley, North East, Pa.

498,435. ELECTRIC RAILWAY TROLLEY. Rudolph M. Hunter, Philadelphia, Pa.

498,448. FIRE-ALARM SYSTEM. Joseph Sachs, New York, N. Y.

498,462. ELECTRIC ROTARY FAN. Julian F. Denison, New Haven, Conn.

498,468. ELECTRIC ALARM CLOCK. William M. Fowler, Milford, Conn.

498,503. INDEX FOR TELEPHONES. Frank S. Blanchard, Worcester, Mass.

498,519. ELECTRIC PERFORATING PEN. Aaron D. Lewis, Canton, Mo., and Silas Witherell, Fort Madison, Iowa.

498,537. DYNAMO-ELECTRIC MACHINE. Charles E. Dressler, New York, N. Y.

498,538. ELECTRIC GENERATOR OR MOTOR. Charles E. Dressler, New York, N. Y.

498,539. JUNCTION-BLOCK FOR ELECTRIC FIXTURES. Frederic A. Duggan, Trenton, N. J.

498,560. ELECTRIC CUT-OUT. William P. Machinter, Montreal, Canada.

498,566. ELECTRIC ARC LAMP. Paul Nordmann, Berlin, Germany.

498,570. SUSPENSION DEVICE FOR ELECTRIC LAMPS. James J. Renehan, New Britain, Conn.

498,577. ELECTRIC LOCOMOTIVE. Albert Schmid, Allegheny, Pa.

498,585. ELECTRICAL ROTARY MOTOR. William J. Still, Toronto, Canada.

498,603. SYSTEM OF SUPPLYING CURRENTS TO ELECTRIC RAILWAYS. Charles Zipernowsky, Buda-Pesth, Austria-Hungary.

498,604. ELECTRIC ARC LAMP. Hugh Alexander, Brooklyn, N. Y.

498,674. PRINTING-TELEGRAPH. Donald Murray, Sydney, New South Wales.

498,710. ELECTRIC TIME ALARM. Charles S. Gibson, South New Berlin, N. Y.

498,722. TROLLEY FOR ELECTRIC CARS. Robert D. Nuttall, Allegheny, Pa.

498,723. ELECTRIC-RAILWAY TROLLEY. Robert D. Nuttall, Allegheny, Pa.

498,735. ELECTRIC WELDING APPARATUS. John H. Bassler, Myerstown, Pa.

498,743. GALVANIC BATTERY AND ELECTRICAL TOY INSTRUMENT. William A. Connelly, Boston, Mass.